APR 23 1934

ELECTRICAL WORLD

Faster Reclosing Breakers Needed

. . . says an operating engineer

Induction Furnace Energy at Low Cost

. . . manufacturer shows where advances and economies lie

How to Measure Net Returns from Merchandising

. . . on the basis of a West Coast utility's successful experience

Distribution Lines – 1934 Model

. . . unconventional, easy to look at, refreshingly different — Detroit Edison

Duct Splices Rescue Cable from Junk

. . . Kansas City finds organized salvage to pay well

April 21, 1934

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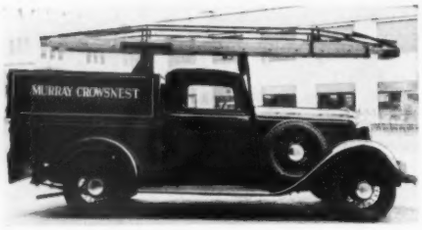

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ELECTRICAL WORLD

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Our Plans for a 1934 "Electrical World"

Nearly forty-eight hours of discussion and planning for a better "Electrical World!" That occurred last week when editors, circulation men, salesmen and publishing executives got together in New York and submitted their ideas and suggestions. The resulting plans will bear fruit in the pages of the magazine very quickly. This meeting of many men was more than a get-together. It welded everybody into enthusiastic support of the electrical industry and the service that may be rendered to this industry. For the electrical industry is well on the way out of the depression. All believed that "Electrical World" could be of even greater service. Needless to say, the editors are pleased that the faith engendered by this meeting permits them to go forward at once with plans long held in abeyance by the depression. Watch us step! Pardon our enthusiasm!

Raking up the backyard

Some people seem to be disturbed by a renewed wave of publicity out of Washington and in some states based upon the long-continued Federal Trade Commission investigation. We are not. We hold no brief for mistakes and errors made by a minority of the industry in the past, but we know that the industry of today knows better and behaves better. These superficial irritants raked up from the past should not be permitted to obscure the picture. There is a good job being done today and there is still a big job to do. This, and not politics or newspaper stories, should engage the attention of electrical people.

●

That reclosing breaker idea used down in Georgia should apply to all kinds of service—page 571.

Seelye of Detroit has some good ideas on a 1934 model of distribution lines—page 574.

Rescue of serviceable cable from junk means good housekeeping, a task that even top engineers are now giving major attention—page 576.

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April 21, 1934

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VOLUME 103 . . . NUMBER 16

Faster Reclosing Breakers Needed 571
By J. T. LOGAN, Georgia Power Company

Distribution Lines—1934 Model . 574
By HOWARD P. SEELYE, Detroit Edison Company

Municipal Rate Cut; Use Jumps . 578
By R. A. MITCHELL, Louisiana Power & Light Company

Furnace Energy at Low Cost . . . 584
By C. M. LAFFOON, Westinghouse Electric & Manufacturing Company

Returns from Merchandising . . . 587
By H. O. HUSSONG, California Oregon Power Company

Surplus Capacity Cut Shown by 1933 Figures 572
Chart a Practical Guide to Code Wiring Adequacy 573
Duct Splices Rescue Cable from Junk 576
Machinery Rehabilitation Quickly Shows Savings 579
Few P.W.A.-Municipal Loans Used for Competing Plants ... 580
Synthetic Daylight Aids Poor-Vision Pupils 581
March Factory Energy Use Far Above 1933 582
Samuel Fergusion Says —— 586
Spark-Gap Protection Limits Breaker Tripouts 590
Outrigger Pole Design Aids Joint Junction Clearances 591
Dual-Motor Drive Permits Two Operating Speeds 591
Rubber Mounting Benefits Shown by Mercury Pools 591
Stainless Steel Properties Classified by Groups 592
News of the Week 594
Men of the Industry 603
New Equipment 604

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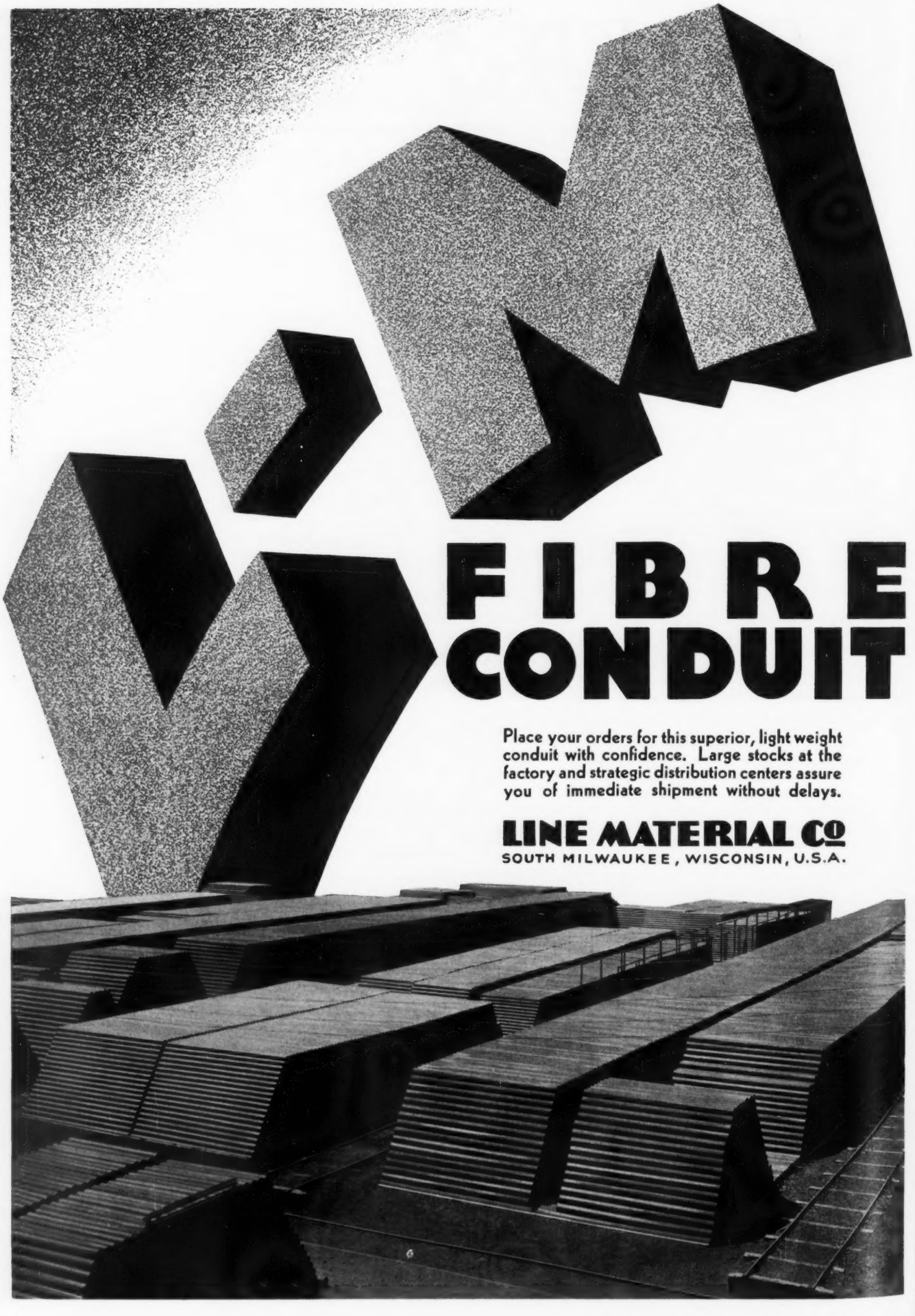

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ELECTRICAL WORLD

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April 21, 1934

L. W. W. MORROW, *Editor*

On the Threshold of a New Electrical Era

Electric power is accepted by industry as the best power. Electric light stands supreme in comfort, convenience and adequacy. Electrical communication has made one great family of the world. These things are recorded to the glory of electrical engineers.

What remains to be done? The answer of the electrical engineers is that there is far more to be accomplished than has been done—or even dreamed of. But, unfortunately, the answer of too many non-technical electrical industry men shows less imagination or courage. The engineer group is familiar with the imperfection of present accomplishments, with the knowledge of recently developed new products and new technology, with reasonable expectations from the research workers. The non-technical group too frequently has been concentrating only upon the business vexations that came with the depression and the New Deal. But the engineers have the truer knowledge and the better perspective.

At this time the electrical industry should follow the advice of Marcus Aurelius and "go forward by the straight path, pursuing your own and the common interest." In industry, electricity is represented largely by the motor only. Electric heat, electrochemical processing, air conditioning, electric control and numerous embryonic industries that will become full-fledged in the near future offer great possibilities. One talks about 600 kw.-hr. per home per year, when the actual accomplishment of 4,500 kw.-hr. per year is to be found in several instances. One looking at the new equipment developed in recent years should appreciate the enormous amount of technological obsolescence that is certain to create a huge replacement market. There are, at least figuratively, anti-complacency bombs nearing completion in research laboratories. In manufacture, in transportation, in the home, on the streets—electricity and electrical products promise contributions far larger than those made in the past.

Electric power in the future will be so cheap that its use will be abundant. Electrical products and services will be so numerous that their aggregate volume will stagger the imagination. Present markets are unsold, new markets will be opened, present costs will be reduced enormously. This great boon for mankind will not be stopped by artificial barriers such as legislation, taxes, lack of money or a host of real and imaginary handicaps. This is the future of the electrical industry. It is not a prophecy, but a reasonable assumption based upon knowledge and rational perspective. Electrical industry men will work enthusiastically to bring this future to hand. The work is here to be done, the incentives exist and the handicaps are minor. Stimulated by their environment and firm with faith in the future, electrical men are going forward.

With Proper Instruments Wiring-Checks Pay Well

Creeping inadequacy is an insidious disease to which industrial wiring systems are peculiarly susceptible in changeful times. Periodic check-ups of voltage regulation, load incidence and internal feeder layouts are increasingly important under present conditions of business. Industrial codes put a premium on intensive production during allotted hours of work and warrant a more

critical attitude on the part of the engineer toward wiring adequacy. Even partial shutdowns of service in a manufacturing plant cannot be viewed tolerantly, for recent improvements in wiring devices, switches, fuses and instruments go far toward putting circuit performance on a firmer basis of reliability and efficiency than of old.

Complete sets of recording instruments regularly calibrated represent a first-class commitment. It is not enough to depend on occasional thesis work by neighboring senior students in engineering in keeping industrial wiring layouts modern. The organization of analytical work for plant staff handling in times where costs are favorable should go hand-in-hand with better records. The relation between surplus wiring capacity and flexibility of service deserves engineering study in connection with fluctuations in production volume. Materials, equipment and methods are now available by which to attack wiring betterment problems on a large and profitable scale in industry.

Voltage Regulation Benefited by "Smooth" Tube-starters

Lamp voltage can change considerably without attracting notice provided it does not change too rapidly or too often. This is a physiological-psychological factor which has not had full play in balancing the economic factors that determine where voltage regulation is best effected. In fact, practically every element of technique in a.c. practice conspires to inject abrupt dips in voltage that are followed by equally abrupt moves to compensate.

Perhaps nothing can be done to ameliorate the abruptness of non-motor loads coming on. But much more can be done to relieve the step-by-step motor starting, which inevitably creates a current jolt at each transition. Since much of the quick adjustment at the regulator follows the frequent starting of motors, it will pay to explore the possibilities of retarding and "smooth" types of motor starters as a way of circumventing the high cost aspects of built-in line capacity and its supplementary regulation equipment. Could motors be prevented from imposing their frequent sharp dips in voltage the occasion for incessant regulation would be greatly reduced. Among the possibilities which await adaptation to this field are the electron tube, the various forms of rectification and the carbon pile rheostat.

How Much Free Service Should a Utility Render?

Has servicing without charge reached the burdensome point in utility circles? Some companies have begun to think so and believe that the time has arrived to take account of stock in these practices before extending them, if indeed curtailment is not in order. Customers in many localities have come to expect a great deal as a result of pioneer work by the power companies and the tendency to go to these organizations for advice on all sorts of electrical matters. Good reason exists for keeping well inside the bounds of sound business practice in aiding customers.

The use of electricity will grow too slowly if this work is transferred to organizations lacking the customer viewpoint, but this problem will be far less difficult if the interested parties agree to solve it on the basis of fair prices and alert response to public needs. It would be timely to investigate the whole problem of free service; to find out whether uniform policies should be established by utilities; the charges, if any, to be established, and the desirability of allocating service work to different groups in the local industry.

Massachusetts Takes a Stand for Justice and Good Service

Courage and discernment went hand-in-hand last week (ELECTRICAL WORLD, April 14, page 558) in the Massachusetts commission's refusal to order a rate cut for the Lynn Gas & Electric system in the face of falling revenue and uncontrollable cost increases, forced by the recovery program, despite sound management and better service per dollar of customer money than would have obtained under municipal ownership. When has a regulating commission previously taken the political risk of putting down in cold figures the superior economy of private ownership in an important local rate area?

Had times been normal, the board might have ordered a change in rates with the idea that a cut would stimulate usage enough to offset the losses in a short time, but not so here. The radicals may rant, but the facts are with the Bay State Board, and the unanimity of its finding adds weight to its conclusion that the Lynn company is doing a good job for a fair price in its territory.

Faster Reclosing Breakers Needed

By J. T. LOGAN
Operating Engineer
Georgia Power Company

If heavy-duty service is to realize the advantages which radial feeders and light tie lines have gained through automatic reclosing breakers speed of action will have to be increased.

Present applications restore normalcy within one to two seconds following 90 per cent of tripouts, says author, and then points a way to further improved service.

THE rapidity with which the industry has accepted the practice of instantaneous initial reclosing of circuit breakers is an indication that the practice is fundamentally sound, when properly applied, and results in material improvement in service to customers. Until breakers with very much faster closing characteristics than those now available are manufactured this practice will probably be limited to radial feeders and light tie lines serving intervening loads, as the sluggishness in closing even the most modern breakers would prevent returning heavy trunk or tie lines to service before possible instability occurred between generating centers. High-speed breakers for this class of service might reduce the number of tie lines required to provide stability by making it possible to clear a fault on one line and return it to normal operation before instability results.

Practically all feeder and many tie line (44 kv. and below) breakers on the Georgia Power Company's system have been equipped for instantaneous initial reclosing where the breaker mechanisms are adaptable to fast reclosing. The 1933 performance record for the reclosing duty cycle we are using almost exclusively, viz., 0-15-120 seconds, shows a decided improvement over the 1932 record. This great improvement is traceable to more alert inspection and maintenance of breakers and lines, better tree trimming and improved automatic reclosing relay schemes.

In order to eliminate the possibility of errors in the performance record the following tabulation lists only the circuits where accurate records are kept:

Circuit Volts, Kv.	Number of Breaker Tripouts	Reclosure* First	Reclosure* Second	Reclosure* Third	Lock-outs	Failure† to Reclose
66.0	30	28	0	1	1	1
44.0	460	408	14	2	36	6
38.0	475	430	29	4	12	9
22.0	9	8	0	1	0	0
6.6	12	10	0	1	1	0
4.0	24	12	3	4	5	0
Total	1010	896	46	13	55	16
Per Cent	100	88.7	4.5	1.3	5.5	1.6

*Reclosure after which the breaker remained closed.
†Failures traceable to reclosing control equipment 9
Failures traceable to breaker mechanical faults 7
"Failures to reclose" are omitted from number of "breaker tripouts" in order to give a better idea of the reclosing probability.

The improvement made in 1933 is shown by the following comparison:

	Number of Breaker Tripouts	Reclosure* First	Reclosure* Second	Reclosure* Third	Lock-outs	Failure to Reclose
		Per Cent				
1932	1,042	77.9	15.7	3.9	6.7	29
1933	1,010	88.7	4.5	1.3	5.5	16

*Reclosure after which the breaker remained closed.

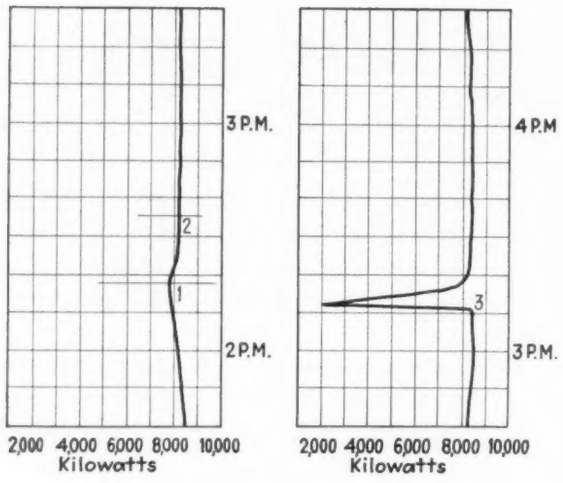
Customer service improvements

The average industrial customer is not in position to co-ordinate his motor-control equipment with instantaneous restoration of voltage without assistance from control experts. We have, therefore, adopted the policy of investigating the customer's equipment, without cost to him, and furnishing recommendations as to desirable changes. Our power sales engineers arrange for the investigation and are our most ardent advocates of instantaneous initial reclosing. It is through this procedure that we are able to convince the customers of the value of proper time-delay undervoltage protection. A conservative estimate would be that within the past three years motors aggregating 50,000 hp. have been properly protected.

In applying the reclosing duty cycle of 0-15-120 seconds we have, in many instances, ignored derating factors. During the past 2½ years we have experienced more than 3,000 tripouts of breakers equipped for instantaneous initial reclosing, and in more than 200 instances the breakers reclosed before the fault had cleared and were consequently required to interrupt the short circuit a second time within one second. To date, not one breaker failure is traceable to the second opening, or, as a matter of fact, to the third or fourth openings, which in the writer's mind indicates that too much significance has been attached to the time interval between breaker operations in establishing breaker interrupting capacities.

That faster closing breakers will be needed in the future is no longer a question of speculation. While we are now able to maintain satisfactory service on feeders, where industrial loads are properly protected, with breakers that make the round trip from close to open and close again in ½ second, the disturbance could be considerably reduced through faster breaker operation.

Faster relaying of circuits is just as important as



Reclosing performances compared

The left-hand chart shows the load supplied a 38-kv. bus where all feeder breakers were equipped for reclosing duty cycles of 0-15-120 seconds. The chart at the right shows the load supplied a 38-kv. bus where the feeders were equipped for reclosing duty cycles of 60-60-60 seconds.

(1) Two feeders supplying a total load of 5,500 kw. tripped simultaneously. Both feeder breakers reclosed instantly. Obviously, no service was interrupted.

(2) Same as (1) except only one feeder supplying 1,500 kw. was involved.

(3) One feeder tripped. The feeder breaker reclosed in one minute. The loss in revenue by the power company from 350 kw.-hr. lost in load was negligible compared to losses of the industrial customers whose processes were abnormal for seven minutes.

faster closing of breakers; however, the problem of coordinating operation of high-tension transformer fuses with relays necessitates delaying the time for tripping the breakers. For small transformers usually ½ second delay in tripping is sufficient to provide fuse selectivity; however, for large transformers it is sometimes necessary to delay the tripping as much as one second, if full selectivity is obtained. The time lost in relaying is very valuable, and it is hoped that some economical method of protecting small transformers will be developed which will give selectivity with feeder breakers equipped for high-speed relaying.

Completely suitable means for removing and restoring excitation to synchronous motors and condensers have not yet been provided. The relay for performing this duty should be able to distinguish between trouble on the feeder supplying the motors, or condensers, and trouble on another feeder supplied from the same bus, or even on the supply source to the transmission substation. The reactance of small synchronous motors and condensers is usually so great in comparison to that of the feeder that the pump-back from this class of equipment is about as great for faults anywhere on the transmission system as for those on the high-tension terminals of the transformers supplying the motors or condensers. This complicates the task of removing excitation properly. The fields could, of course, be removed for any disturbance, but this procedure is very undesirable if possible to avoid. Rapid removal of the excitation on this class of equipment is essential to satisfactory application of instantaneous reclosing, as failure to do so permits maintaining the arc too long for instantaneous reclosing, thus necessitating some delay in reclosing the breakers.

In October, 1932, after experimenting with the 0-120 seconds reclosing duty cycle we adopted the 0-15-120 seconds cycle. This was because of the greater value of the second reclosure when preceded by an instantaneous reclosure. This is particularly true on lower voltages, where tree limbs are the chief source of trouble. Breaker performance under this latter reclosing duty cycle has been entirely satisfactory, therefore we can see no reason for reverting to only two reclosures.

Instantaneous reclosing has not been applied to underground cables on our system, as the records indicate too large a percentage of permanent cable faults. Neither has the practice been extended to indoor breakers, largely because most of our indoor breakers control underground circuits.

Favorable results obtained

Having done considerable pioneer work in connection with instantaneous initial reclosing of circuit breakers we receive many requests for information on various phases. One inquiry that should be of general interest is: What percentage of the load is actually held by this practice? The answer is that we are actually holding from 90 to 100 per cent where the customer's control equipment has been properly co-ordinated.

Surplus Capacity Cut Shown by 1933 Figures

That the increase in industrial activity during 1933 had an immediate effect on electrical energy consumption is well known. But to discover how individual electric power companies have fared in the general upward swing, to find where normal margins between installed capacity and peak demand are being approached or perhaps exceeded, where additional generating and distributing equipment may shortly be needed, where the growth of industrial loads indicates a market for motors, control apparatus and line material, where the greatest progress has been made toward building up domestic consumption and where present subnormal use points to opportunity for developing a market—to answer such questions as these calls not for general averages but for detailed statistics.

Such statistics on operations in 1933 are shortly to be published in the Annual Supplement to ELECTRICAL WORLD. Data will be given on 137 systems in the 100,000,000-kw.-hr. class in the United States, as well as others in Canada and Mexico. Of that number, 25 had a total output exceeding 1,000,000,000 kw.-hr. This is two more than in 1932. All but four of these had a larger output than in 1932. Eight of them overshot their 1931 figures; seven surpassed 1930; three equaled or exceeded their previous maximum, not counting two others that were not in full operation in 1929. Several more missed it by narrow margin.

Of these 25 returns four show generating peaks as high as 94 per cent of capacity, or higher. Three are from wholesaling companies and heavy loading of their plants is not surprising; the other one, however, represents diversified service on a system with the unusual load factor of 55 per cent.

Meanwhile, the weekly figures point to a growing in-

dustrial consumption in 1934. To this will be added, later in the year, the rising lighting loads.

Excess capacity that may still exist on one system is of little help to a company in another part of the country. National or regional averages tell but a part of the story. Only a study of individual cases will show where opportunity beckons.

Chart a Practical Guide to Code Wiring Adequacy

By JOHN W. SHALLENBERGER
Consulting Engineer, Bridgeport, Conn.

Stress on "adequate wiring" to meet ever-increasing demands for higher standards of lighting and for more power focuses on the calculation of feeder, main and branch sizes. Limits imposed by the National Electrical Code are not intended to take care of all factors involved, being directed at safe heating within insulation limits.

Especially on the larger industrial and commercial systems is it necessary to remember that lamp efficiencies and motor performance suffer unless excessive voltage drops from inadequate wiring are avoided. Architects and plant engineers should find the accompanying chart an aid to specifying adequate wiring. It covers both d.c. and 60 cycle a.c. in conduit where separations are only those due to conductor insulation. The a.c. values are for 95 per cent power factor (assumed for lighting alone), 85 per cent for lighting and small motors and 80 per cent for motors alone. These assumptions provide for a large proportion of the installations.

Intervals between wire sizes are about 25 per cent and this makes it unnecessary for the chart to be more precise than the approximate formulas for voltage regulation upon which it is based. A factor for the apparent increase in resistance because of skin effect has been introduced for the larger sizes of wire. For the larger wires the skin effect and inductive reactance increase rapidly; therefore, where large sizes are indicated, it is more economical to compute the conductor size for a fraction of the load and then use correspondingly more conductors in multiple for each lead.

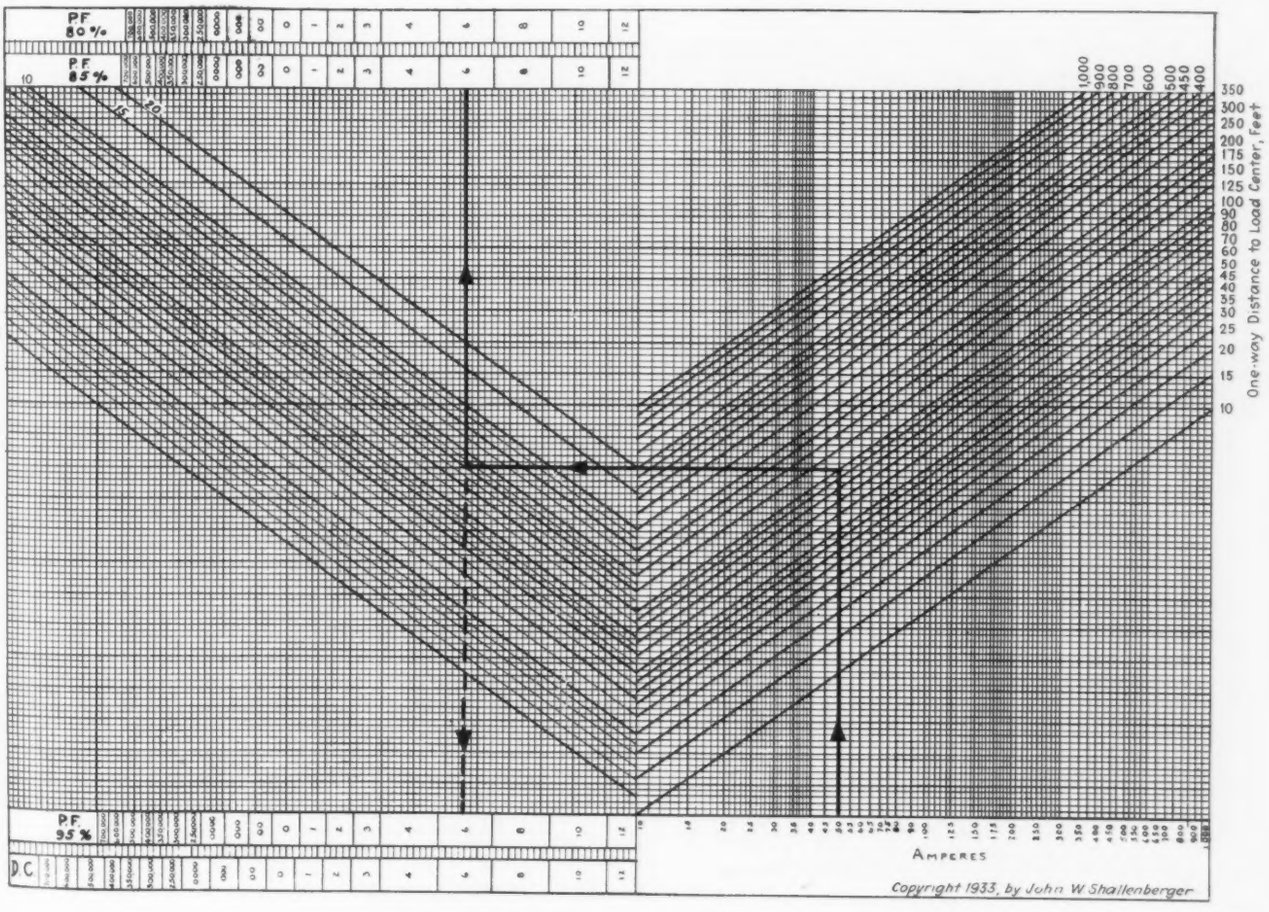
As a guide to determining the proper voltage drop allowable in any given case, the following table is included as giving values which are considered good practice:

	Lighting		Power
	110-Volt	220-Volt	220-Volt
Branch	1 volt	2 volts	1 volt
Sub-feeder	$\frac{1}{3}$ remainder	$\frac{1}{3}$ remainder	$\frac{2}{3}$ remainder
Feeder	$\frac{2}{3}$ remainder	$\frac{2}{3}$ remainder	$\frac{1}{3}$ remainder
Total	3 volts	6 volts	10 volts

Chart gives wire sizes for d.c. and a.c. feeder and branches

First: Determine the amperes per conductor and use this figure for single-phase and two-phase circuits. For three-phase circuits multiply by 0.866.

Second: Drop in volts is referred to same voltage as that used in deriving the amperes. Drop to neutral in d.c. or single-phase, three-wire circuits will be one-half that on chart and for three-phase, four-wire circuits will be 0.577 times that on chart.



Distribution Lines

Restyling for better appearance is today the preoccupation of producers who are learning that eye appeal is the first and perhaps most powerful selling force.

People do not buy distribution lines, but they have to look at them. And what the lines represent must be sold. So why not give a little thought to their appearance?

POLE lines are the one evidence of the power companies' existence which the public has always before it. They are seen everywhere on streets, alleys, easements and private property. These lines are being built today essentially as they were built when the industry began, and as communication lines had been built for years before that. They use the most obvious, simple type of support, an arm square across the pole and a strap brace to keep it from canting. How much thought has ever been given to improving the appearance of this structure? If a substation or even a warehouse is to be built its architectural features are considered carefully so that it will look well and correspond with other buildings in the neighborhood. Yet, where one substation is built, miles of distribution lines on wood poles are installed. The most prominent feature of a power company's facilities has had the least attention given to its appearance. There is no doubt that marked improvements could be made and at comparatively little additional cost if the problem were fully recognized and properly approached. A new design embodying several radical changes from the older practice is being tried out by the Detroit Edison Company for locations where good appearance is especially desirable. This article discusses the fundamental principles on which it was based and describes its most important features.

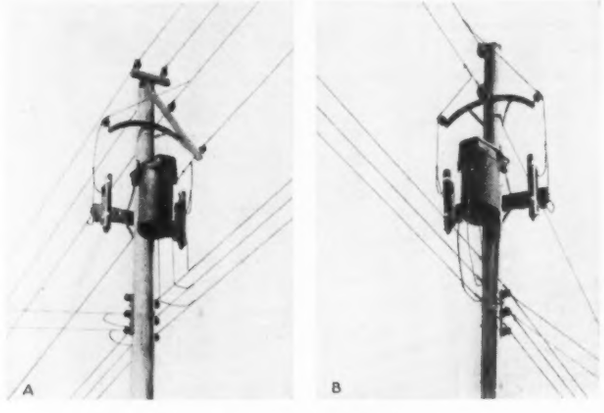
Aside from the general desirability of having any structure look as well as possible, there are two specific reasons for improving the appearance of pole lines. The first is the effect of creating a better impression on the public, which, although accustomed to the present lines through long association, would, without doubt, react favorably to an improvement. The second is the possibility of avoiding demands for underground distribution. Such demands are very often based directly on objections to the appearance of overhead lines. A better appearing line might satisfy many of the conditions where the much more expensive underground is now considered necessary.

Idle pin space avoided

In attempting to create a better design certain elementary principles of good appearance should be recognized. The first is that the construction should be neat and the workmanship good. The next is that unnecessary material should be eliminated. On any structure, material which serves no useful purpose is fundamentally unsightly. A corollary to this is that unused wire positions should be eliminated as far as possible. A common practice is to provide, at the time a line is built, crossarm space for possible future wires, even though their installation is quite improbable. For example, many companies use a standard six-pin crossarm for any number of wires from two to six. This unused space should be eliminated, if possible, in an improved design.

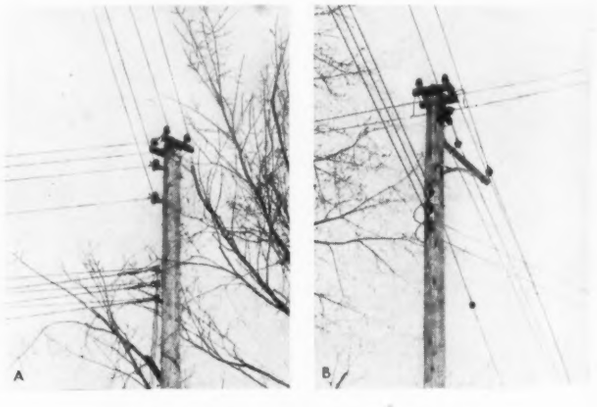
A more pleasing configuration of the pole-top structure is much to be desired. The ordinary square-arm, 45-deg. brace combination is anything but beautiful. There are a great many different ways in which this purpose might be accomplished, depending on the judgment and taste of the individual designer. They are limited, however, by some of the other requirements. The ornamental arrangements used on street-lighting poles may be cited as indicating some of the possibilities.

Certain other practical requirements must be kept in mind. The cost should, if possible, not be more than that of present construction. Proper clearances and strength must be maintained. The general design and the parts used should be adaptable to all variations in



Transformer installations

(a) Street-lighting circuit, two-wire primary and secondary straight through. Note crossarm brace extended for training lead to primary fuse.
(b) Primary dead-end. Crossarm brace for training leads.

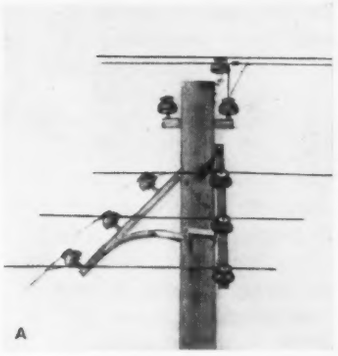


Corner constructions

(a) Note street-lighting circuit turned on 45-deg. double arm. Secondary dead-end on rack.
(b) Buck arms used at four-way street-lighting circuit corner. Primary straight through in this instance, secondary dead-end.

—1934 Model

By HOWARD P. SEELYE
Engineer the Detroit Edison Company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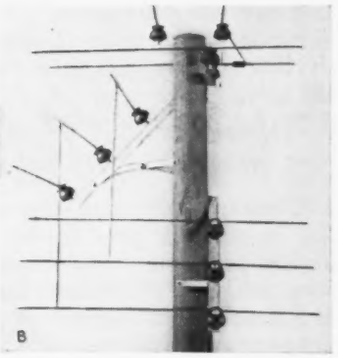
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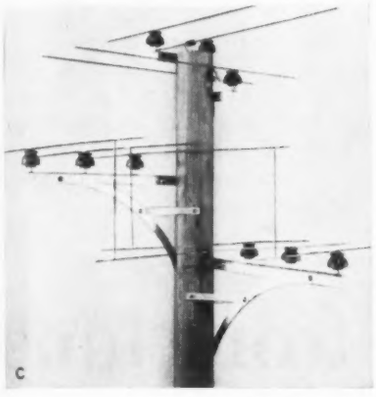
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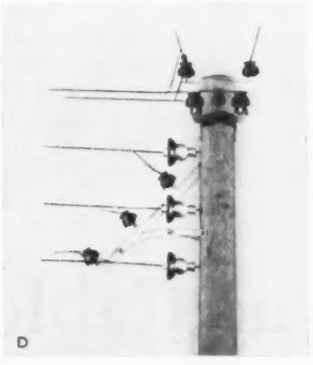
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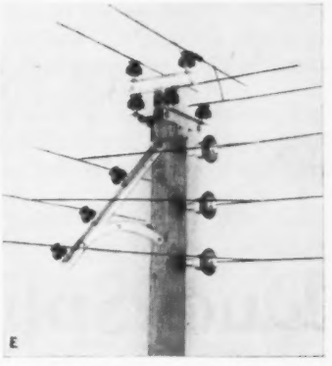
Corner designs in models

(a) Four - way, primaries on same level.
(b) Four - way, primaries on different levels.
(c) Four - way, primaries on different levels with arm horizontal to save space.
(d) Three - way, tap on line side of pole.
(e) Three - way, tap on side opposite line.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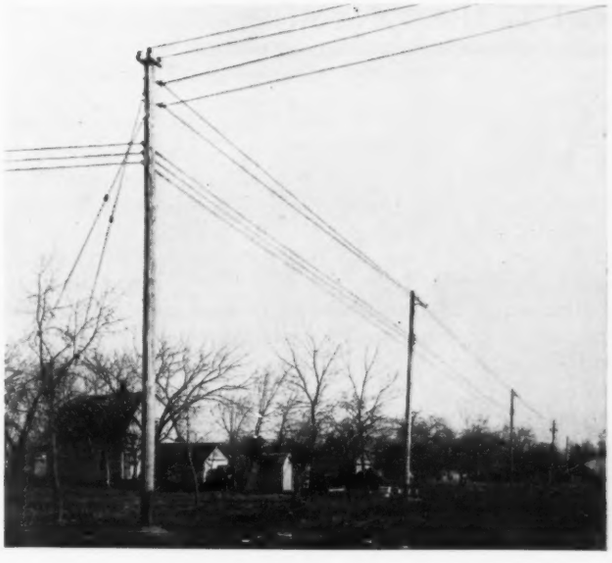
field conditions in order to avoid the necessity for special, seldom-used materials.

Conventionalized tree form

The new design described here was worked out, keeping in mind all the requirements which have been mentioned. It is intended especially for use on light distribution lines in residential territory, where the number of wires carried is limited to one primary circuit (two or three wires), one street-lighting circuit and one secondary circuit. It can be readily adapted to other conditions with more wires if desired. The chief features of the design are as follows:

Poles—No change from ordinary standards. Reasonably straight poles and not overly large for the strength needed should be used.

Primary Crossarm—The unusual configuration of a slanting arm and a curved brace is shown in the accompanying illustrations. This was based to some extent on conventionalized tree forms and is similar to that used on some ornamental street-lighting poles. The arms used are $2\frac{1}{4}$x$2\frac{3}{4}$-in. Douglas fir, with steel pins for the insulators. Arm and braces are reversible so that they may be placed on either side of the pole, or used as double arms. Wires are tied in the side groove of the insulators. The wire spacing is made as small as possible for compactness, being 12 in. where all three primaries are installed. For 4,800 volts insulated wire is used for the middle wire to avoid trouble from accidental contacts. A large percentage of line has only single phase, for which the outer positions are used, 24 in. apart, with ordinary weatherproof wire. The slanting configuration is believed to be of some advantage in avoiding accidental wire contacts. It should be noted that the only unused wire space in this construction is the middle position when single phase only is present, since the street lighting is carried on a separate arm.



A clean line

Street-lighting circuit dead-end on double arm. Primary corner on strain insulators.

Street-Lighting Arm—Since the street-lighting circuit is always two wires and is normally spaced only 14 in. apart a short separate arm is installed at the pole top for it. This is used only when the street-lighting circuit is present and thus avoids unused wire space on a large percentage of poles.

Transformer Installation—As shown in the illustrations, this is designed for compactness and accessibility of parts. It has all the necessary clearances with a minimum amount of space occupied. The transformer is hung on steel plates bolted directly to the pole. Fuses

and arresters are mounted on a 2x6-in. arm on the opposite side of the pole. The curved brace used here for the line arm has an extension for training the wire across the pole.

Secondary—Ordinary secondary-rack construction is used, which fits in very well with this design.

Corner Construction—Strain insulators bolted directly to the pole are used at 90-deg. corners, avoiding unsightly buck-arm construction. This type of corner has been long used for farm line construction and is just as suitable here. A number of variations of three- and four-way corners, as worked out on a small model, are shown in one of the illustrations. The 90-deg. street-lighting circuit corner is made with the small arm placed to bisect the angle. The wire being small, this arrangement is strong enough and saves pole space.

Cost—The cost of this type of construction is not greatly different from that of the old, conventional type. Savings are made by the smaller arms, the elimination of unused space and the cheaper construction at corners. The chief element of increased cost is the insulated wire necessary for the third phase if it is installed. No general cost figures for a large amount of construction are available, but it is anticipated that the new design will not increase the average cost, and a reduction in cost may be found when a reasonably large amount is built.

Consideration of this new design, in view of the requirements for improved appearance previously enumerated, will show that it fulfills them well. It eliminates unused material and unused wire space to the greatest possible degree and introduces a new and more pleasing configuration. While individual opinions on this point may differ, the majority who have seen this construction in place have expressed their approval of its appearance. It has sufficient strength and proper clearances. The parts are comparatively few and of universal application. All these advantages have been gained at no appreciable increase in cost. It is believed that the desirability of better appearing lines is evident and that this design is at least a step in the right direction.

Duct Splices Rescue Cable from Junk

By T. G. HIERONYMUS*

Kansas City Power & Light Company, Kansas City, Mo.

Kansas City utility finds that duct splices not only salvage cable but release reels for credit, reduce cable storage space and provide employment.

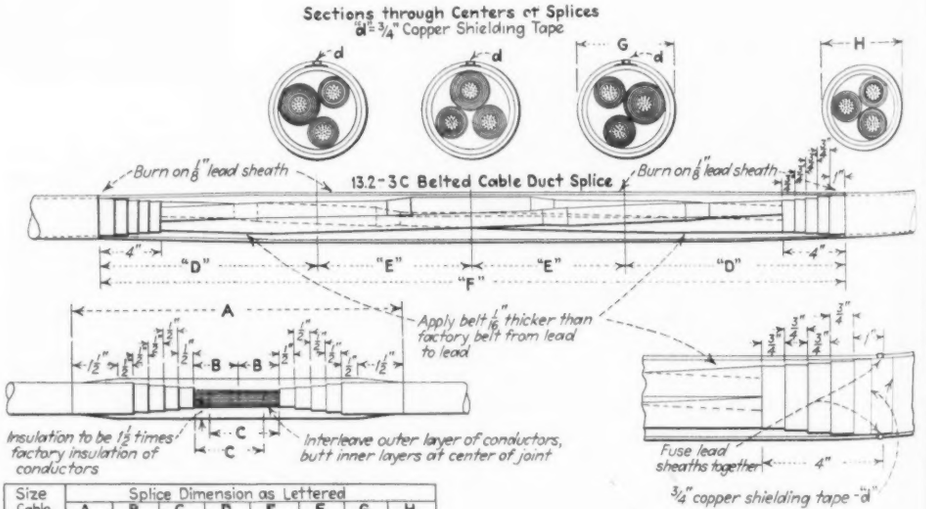
AT A typical over-all total cost of $52 for each splice in No. 3/0, three-conductor, 13.2-kv. cable, the Kansas City Power & Light Company is now engaged in making 117 duct splices which will convert about 161 short pieces of various voltages and sizes that have been cluttering up the warehouse for years into about 44 standard lengths of cable. More than just the economy of transforming useless into usable material can be credited to the undertaking. About 45 reels will have been made available for credit return, cable storage space is greatly reduced and, of considerable importance in these days, work is being provided. Two splicers and a helper will be employed for several months, a crew of reel handlers will have many hours work and the testing of the finished cable will provide occupation for, and thus probably prevent reduction in, a number of laboratory employees.

There are several methods of attack in figuring the economies of such a job as this. For simplicity only the relation between the junk value of copper and lead in short lengths of cable now on hand to that of a new cable of standard conduit section length (405 ft.) is taken into account. The cost of stripping lead and in-

**From paper to Engineering Conference, Missouri Valley Electric Association.*

Duct splice kept to small diameter

This splice is for 13.2-kv., three-conductor belted cable. In the conductor joint the outer layer of strands is bent back and the center core cut and butted together. Alternate strands of the outer layer are cut back. The long strand of one side is butted against the short strand of the other side. All are bound in place with black annealed iron wire. The strands are then sweated solid together and the iron wire removed. Note the pieces of copper shielding tape, "d," which are laid below the lines of jointure of the sheath to prevent scorching the insulation during the lead burning process.



Size Cable	Splice Dimension as Lettered							
	A	B	C	D	E	F	G	H
400 MCM	12	2	3 1/4	16	15	62	3 5/8	3 1/4
3/0 B&S	10 3/4	1 3/8	2 1/4	14	10	48	3 3/32	2 1/16

Duct Splices Scheduled, March 7, 1934

Kansas City Power & Light Company

Voltage	Average Finished Length, Ft.	No. of Finished Reels or Lengths	Total No. Pieces	No. Splices
13,200	350 to 550	26	71	45
4,500	350 to 550	4	18	14
600	350 to 550	14	72	58
		44	161	117

sulation from the copper is not considered. A machine for such work is available, and as storeroom men do the work in spare time this item can be neglected and only the salvage value as the price obtained in the open market today be considered.

Today's value of junk copper is $0.06 and of lead $0.0325 per pound. New No. 3/0-3C-13,200-volt belted cable costs $1.42 per foot, including testing, etc. One foot of such cable contains 4.98 lb. of lead and 1.56 lb. of copper. The total salvage value is $0.256 per foot.

$1.42	New cable cost
−0.256	Junk value
$1.164	Net difference
405	Length in standard section
$471.42	
10.00	Testing rehabilitated cable
$461.42	Net saving
$52.00	Cost of 1 duct splice
0.51	Salvage value of cable in the splice
$52.51	

$$\frac{\$461.42}{52.51} = 8.67$$ — Number of splices that can be made per section and break even

$$\frac{405.00}{9.67} = \frac{\text{Total length}}{\text{No. of short lengths}} = 42 \text{ ft.}$$

42
2 ft. lost in making each splice
44 ft. = shortest economical length

Therefore it appears economical to splice nine short sections of cable together to produce one 405-ft. usable length of cable. To make such a splice requires the following material and labor:

No. 3/0-3C-13.2-Kv. Kansas City P. & L. Duct Splice

Material			
27 rolls small paper tape, at	$0.0384	$1.04	
4 rolls large belting tape	0.40	1.60	
1 3x48-in. lead sleeve, 24 lb.	0.0555	1.33	
2-lb. sheet lead strips	0.07	0.14	
¼ roll 1½-in. cotton tape	0.20	0.05	
1 pint No. 219 compound	0.04	0.04	
1 oz. Sterine	0.02	0.02	
5 ft. No. 16 black annealed iron wire	0.01	0.05	$4.27
Miscellaneous, including gas for lead burning, coal oil for furnace, wiping rags, special tools, etc., estimated			$1.00
Total material			$5.27
Labor			
2 days, one splicing crew (2 men) at	$10.08	$20.16	
2 days, one extra splicer	6.08	12.16	
1 hour, eight men	4.84	4.84	$37.16
Supervision			3.72
Total labor			$40.88
Engineering and development cost			5.95
Total cost			$52.00

Note: The eight men for one hour are the labor crew that handles the reels and cable as required by the splicer.
One of the splicers applies the tape and the other splicer does the lead burning.

A comprehensive series of tests, including bending, tensile strain, current carrying capacity and insulation, were made at the start of the work to determine best techniques of splicing and resultant qualities of the joints. From these it was readily apparent that much greater care is necessary in making duct splices than ordinary manhole joints. This is because the thickness of the duct splice must be kept at a minimum and it is not possible to apply any considerable amount of extra tape for insulation. It was found better also to step, rather than to pencil down, the mill insulation on each side of the conductor joint. Each standard length of cable as built up from the short pieces is tested on its reel for dielectric strength and resistance before consignment to stock.

Curb-Accident Efforts Effective for Ohio Edison

Accident prevention team activities of this utility have in four years decreased the lost-time accidents from 56 to 9.

That accident prevention activities actually yield a decrease in lost time and human suffering is shown by the comparison of figures for the last four years of the lost-time accidents of the Ohio Edison Company, Akron, issued recently at the time of the 1933 divisional contest banquet. In 1930 the report shows there were 56 lost-time accidents, which number decreased to 22 in 1931, fifteen in 1932 and only nine in 1933. All employees except the Akron general office staff are grouped into safety teams of approximately 50 members each. All teams completing the year without the loss of any time from personal injuries are the company guests at the annual safety dinner, and the division, of which there are three, Akron, Springfield and Youngstown, having the best safety record for the year is presented with a safety trophy.

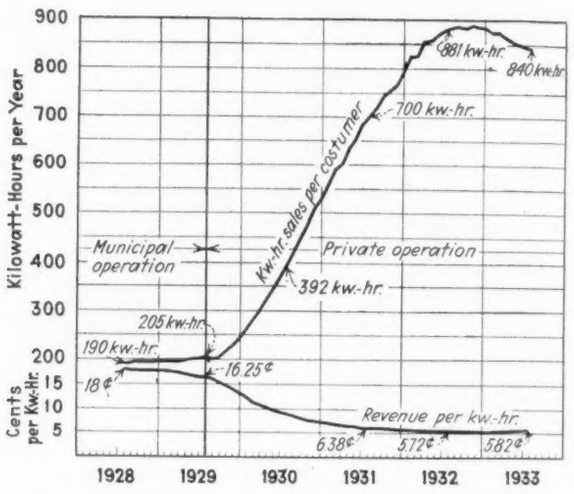
Each safety team has a chairman and secretary and holds a conference meeting monthly at which safety suggestions and recommendations are offered by team members. Committees are appointed to investigate these and carry them out if they are found to be feasible. In these group meetings protective devices, care and inspection of equipment, unsafe practices and physical hazards are discussed and corrective measures agreed upon.

Division records compared for 1933

Of the seventeen teams on the property, thirteen of them were entirely free of accidents in 1933. The total of nine accidents represented a total number of days lost of 12,580, of which 12,000 is accounted for by the fatal injury of two employees in the Youngstown division (National Safety Council classification). In all, the company employed 1,427 during the year, who worked a total of 3,564,596 hours, so the number of days lost is small. The Akron division, which won the 1933 contest, had only one accident, involving 132 days lost to a telephone operator not included in the contest, and had a total number of hours worked of 1,616,277. Corresponding figures for Springfield are one accident, 157 days lost with 473,008 hours worked, and Youngstown seven, with 12,291 days lost and 1,475,311 hours worked.

Utility Cuts Municipal Rate; Use Jumps

By R. A. MITCHELL
Secretary to Vice-President
Louisiana Power & Light Company, Algiers, La.



Accompanying a 60 per cent rate slash with an aggressive merchandising program, this utility, absorbing a municipal plant, gains 400 per cent increase in use.

City turns its electric business over to a utility and in addition to liquidating the bonds, gets—
cash to boot
25-year service warrants for street lighting and fire hydrants,
a chance to reduce town taxes,
a 64 per cent reduction in average residential rate.
four times as many kilowatt-hours per home per year.

INITIATIVE of private enterprise in the management of an electric utility as contrasted with the lethargy of governmental operation is strikingly shown in the results obtained at Donaldsonville, La., under both forms of ownership. Installation of inducement type domestic rates permitting an aggressive merchandising program has been largely responsible in building residential load and decreasing the average cost per kilowatt-hour since the abandonment of municipal ownership in this town.

This community, located on the west bank of the Mississippi River 85 miles north of New Orleans, in the commonly referred to "sugar bowl" of Louisiana, is primarily a trading center for outlying sugar and rice plantations. The 1930 census shows its population to be 3,788, an increase of only 43 persons during the past decade. Approximately 40 per cent of the 1930 population consists of negroes, who, if customers of a utility company at all, are usually minimum users. Industrial activity in Donaldsonville is limited to a small ice plant, machine shops engaged in repairing sugar mill machinery and other small miscellaneous industries ordinarily found in almost any municipality of similar size. The town has always been and still is primarily commercial, its economic life being almost wholly dependent upon the agricultural success of neighboring planters.

Sale pays cost of fire service and street lighting

Prior to August, 1929, the city of Donaldsonville operated a municipally owned electric and water system with what might be termed "slightly better" results than other plants of like ownership in Louisiana. Upon disposing of its utility properties, the city relieved itself of all bonded indebtedness outstanding against its electric and water systems by transferring these obligations to the purchasing company, receiving a sizable cash payment and service warrants in an amount estimated to care largely for the city's street lighting, fire hydrants and other service bills for a period of 25 years. Preceding the transfer of ownership, the residential rate for electric service was:

15 cents per kw.-hr. for the first 50 kw.-hr. per month
12 cents per kw.-hr. for the next 100 kw.-hr. per month
10 cents per kw.-hr. for the next 100 kw.-hr. per month
8 cents per kw.-hr. for all over 250 kw.-hr. per month
Plus an additional surcharge of 15 per cent to the above rates.
Minimum charge—$1.25 per month.

The residential electric rate provided for in the franchise granted the private company at the time of purchase called for the following schedule:

For the first four rooms, 20 cents net each month per room and 10 cents net each month for each room in excess of four rooms and 9 cents net per kw.-hr. for the first 6 kw.-hr. per room per month, 6 cents net per kw.-hr. for all additional energy used per month.
Minimum Charge—Based on the number of rooms, but not less than $1 net per meter per month.

Also, at this time, a general residence service rate was installed to encourage a larger use of electric appliances in the home. This new rate was:

$2.50 net each month for the first four rooms and 10 cents net each month for each room in excess of four rooms; and
9 cents net per kw.-hr. for the first 6 kw.-hr. used per room per month,
3 cents net per kw.-hr. for the next 100 kw.-hr. used per month,
2 cents net per kw.-hr. for all additional energy used per month.
Minimum Charge—Based on the number of rooms, but not less than $2.50 net per month.

In January, 1930, five months after the advent of private operation, the energy steps of the residential lighting rate were voluntarily reduced to 8 cents and

Donaldsonville Homes Use 635 More Kilowatt-Hours at One-Third the Unit Cost

	July, 1929	July, 1933
Number residential customers	337	413
Residential kw.-hr. sales for month	5,601	26,472
Residential kw.-hr. sales twelve months ending	66,205	349,734
Kw.-hr. sales per residential customer	16.62	64.10
Kw.-hr. sales per residential customer twelve months ending	204.94	839.92
Residential revenue per kw.-hr. twelve months ending (cents)	16.25	5.82

5 cents and the energy portion of the general residence service rate was lowered to the following:

8 cents net per kw.-hr. for the first 6 kw.-hr. used per room per month,
2½ cents net per kw.-hr. for the next 100 kw.-hr. used per month,
2 cents net per kw.-hr. for all additional energy used per month.

Use quadruples with ⅔ cut in price

The kilowatt-hour sales per residential customer during the last twelve months period of municipal ownership were 204.94, with the revenue per kilowatt-hour for the same period amounting to 16.25 cents. Four years later the twelve months sales had been increased to 839.92 kw.-hr., whereas the cost per kilowatt-hour was reduced to 5.82 cents, an increase in sales of 310 per cent, with a corresponding 64 per cent decrease in cost. The twelve months sales peak was reached in October, 1932, when a high of 889.68 kw.-hr. per domestic customer was established, there being a decrease since that date due mainly to national economic conditions, local bank failures and abnormally low sugar and rice prices.

The accompanying graphic chart and table illustrate the striking development which has been made by private enterprise in building up the residential electric business in Donaldsonville despite adverse economic conditions.

On the date of purchase the generating equipment in the power plant consisted of three oil engines with a combined capacity of 730 hp. connected to generators with a combined rating of 620 kva. Within six months the power company installed an additional 600 hp. oil engine and in January, 1931, the local plant was interconnected with the 110,000-volt high-line system of the company. Power for this high-line system is primarily furnished by a 134,000-hp. steam-electric generating station, but this plant, in turn, is interconnected with several other large stations of comparable size. This interconnection, together with the local stand-by plant and the construction of an entirely new distribution system, insures electric customers in Donaldsonville an adequate supply of power at all times.

Donaldsonville now has a new sewerage system paid for out of cash received for the plant and the city tax rate has been reduced from 11½ mills in 1930 to 9½ mills in 1933, making this city have one of the lowest tax rates in Louisiana. In addition, the city's tax revenue has been materially increased because the tax-free property which it formerly owned, plus subsequent additions and improvements made by the present owners, is now assessed and subject to taxation. Electric lines have been extended into the neighboring country and many customers now enjoy the benefits of electric service who prior to August, 1929, were unable to secure such service.

Machinery Rehabilitation Quickly Shows Savings

Installation of new iron and new coils in a generator and transformer of one user reduced heat losses, saved water and conserved energy. Cost liquidated in four years in both cases.

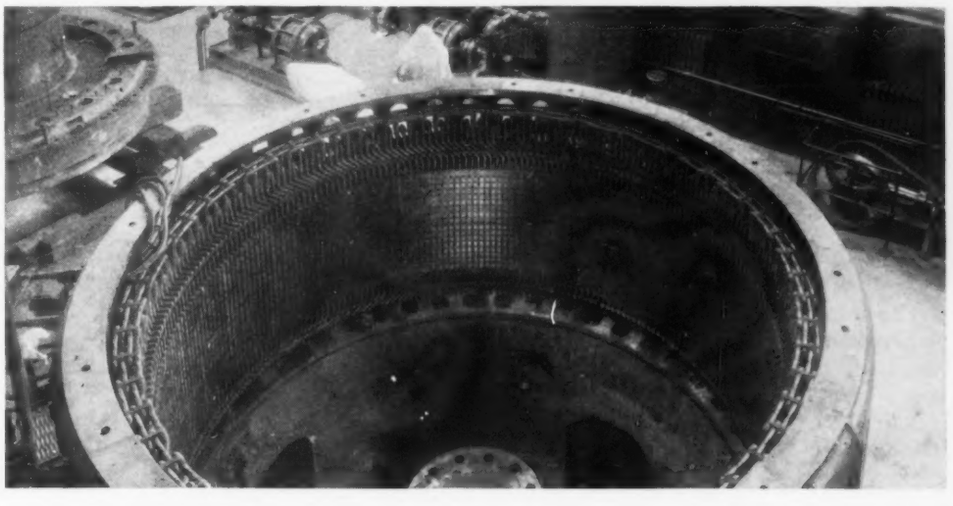
By G. C. BROWN
Central Station Division
Westinghouse Electric & Manufacturing Company, Rochester, N. Y.

When a piece of older equipment fails its repair should be reviewed not only from the angle of the cheapest and most rapid procedure for repair, but the question of possible performance improvement must be considered—true rehabilitation. Proof of such statements are found in typical examples.

Thus an Eastern public utility owns and operates major equipment of the vintage of 1916. The officials were advised of the savings that could be made with present-day material and designs. Certain pieces of this equipment were picked as the most vulnerable and fully considered. Two of these shortly failed.

One of them, a waterwheel generator, had always run at a high temperature—so designed and purchased by the utility. The other, a water-cooled power transformer, attained a high temperature and necessitated the use of expensive cool city water.

An investigation of the generator damages showed that new coils would place it in its former operating condition. Normally, the negotiation would end here and



New cores and coils in this 12,500-kv. alternator cost $30,000, but "paid out" in four years in energy savings

the repairs proceed on this basis. The manufacturer decided, however, to investigate further.

Improvements in generator iron had been made and were known. Applicable new coil designs had been brought out. Better designs of cooling fans and cooling ducts had been introduced.

How would these affect the older machine? Could they be adapted without excessive expense? Would new factory tools and dies be needed? These and many other questions arose; at the outset they seemed a bit disconcerting.

Let us summarize the computed results secured after a thorough research, in the following table:

Calculated Losses at 12,500 Kva., 11,500 Volts, Three Phase, 60 Cycles

Losses	Original Machine, Kilowatt	As Rewound Transposed Coils, Kilowatt	Transposed Coils—New Silicon Iron, Kilowatt
Friction and windage	30	30	30
Core	190	190	110
Arm I^2R	123	104	98
Load	100	90	90
Field I^2R at 130 deg. C.	85	85	85
Total	528	499	413
Armature temperature basis 40 deg. C. ambient	140 deg. C.	130 deg.C.	110 deg. C.

It should be noted that the coils had to be replaced. At such a time the iron could be changed most easily. The savings in a year by the use of new iron alone would be

8,000 hours × 86 kw. × $0.0077 (cost of purchase power) = $5,297.60.

The cost of new iron approximated $11,000. Loss savings would pay for this in a little more than two years and from there on would afford a profit or would justify an investment of approximately $37,100. Viewed as a complete proposition, the savings accruing would be

8,000 hours × 115 kw. × $0.0077 or $7,084.00

Complete repairs cost about $30,000, or the total work could be paid for in slightly more than four years and an investment of about $50,000 could be substantiated.

Briefly, the owner secured an improved, more dependable machine operating at a 30 deg. C. lower temperature by an expenditure that financed itself in about four years—a true rehabilitation project that gave work to people and kept money in circulation.

Further to demonstrate, consider the repair of the power transformer. Coil failure necessitated repair. Investigation showed:

5,000 Kva., Three Phase, 60 Cycle, 11,000 Volts

Losses	Iron	Copper
Old transformer	24,500 watts	46,600 watts
New coil and cores	13,900 watts	34,700 watts
Savings	10.6 kw.	11.9 kw.

Iron—10.6 kw. × 8,000 hours × $0.01/kw.-hr.	$ 848.00
Copper—11.9 kw. × 4,000 hours × $0.01/kw.-hr.	$ 476.00
	$1,324.00

The total cost of repairs was about $4,800, or a total proposition that was self-liquidating in about four years. Again the new iron alone paid for itself in about two years. In addition the cost of water purchased was cut in half.

Without proper knowledge and supervision these instances would have been merely coil winding jobs. Forethought and investigation extended the repairs to a procedure profitable to the owner and manufacturer, made it one necessitating the increased use of labor and one that placed additional money in circulation.

These principles truly define rehabilitation. There is plenty of the superficial repair work that will come to the surface in the immediate future. It can be made into a mutually profitable, labor-employing, rejuvenating program by intelligent consideration.

Few P.W.A.-City Loans Used for Competing Plants

Recent announcement by the Public Works Administration showed a total allocation of about $28,000,000 to some 49 local or municipal projects. Of this sum about $14,000,000 was for two county or regional developments in Nebraska. To find out just what the other projects involved ELECTRICAL WORLD wrote to the cities asking what was contemplated, the total expenditures and the date of completion of the projects.

Representative replies have been tabulated. In the majority of instances the P.W.A. money was to be spent for an extension to an operating municipal system. In two major cases only was it the plan to put in a competing system. It is also noticeable that in many instances municipalities spent additional funds to extend their systems, but that in other cases only the P.W.A. money was spent. This survey shows the magnitude of P.W.A. expenditures for competing light and power systems to be quite negligible. City officials submitted the data from which the following is summarized:

Terre Haute, Ind.—P.W.A. $60,000. Total expenditure $60,000. Street lighting system for business district. Completion July 1, 1934.

Burlington, Vt.—P.W.A. $77,600. Total expenditure $278,000. Extension of present distribution system.

Middlesboro, Ky.—P.W.A. $328,000. Total expenditure $328,000. Municipal power station and distribution system. Work starts July 1, 1934.

Tipton, Ind.—P.W.A. $170,000. Total expenditure $170,000. Now purchases wholesale. Will build a power station.

Belmont, Mass.—P.W.A. $16,100. Total expenditure $63,150. substation addition and office building. Completion July 1, 1934.

Shelby, Ohio.—P.W.A. $160,000. Total expenditure $170,000. Addition of 1,500-kw. turbo-generator to power plant. Completion October 1, 1934.

Alexandria, Va.—Have not heard that P.W.A. has allocated funds.

Augusta, Ga.—P.W.A. $1,250,000. Scheme is embryonic and not yet fully authorized. Uncertain as to final decision even if allocation is made.

Anthony, Kan.—P.W.A. $15,000. Total expenditure $60,000. Addition to existing power house. Completion November 1, 1934.

Fremont, Neb.—P.W.A. $7,300. Total expenditure $28,898. Street lighting system installed.

Columbia City, Ind.—P.W.A. $29,000. Total expenditure $110,000. Addition of turbo-generator to power house and extension of distribution system. Completion October 1, 1934.

Ft. Collins, Colo.—P.W.A. $738,000. Total expenditure $738,000. To build a new power house and to acquire local distribution system. Completion July 1, 1935.

Chanute, Kan.—P.W.A. $25,000. Total expenditure $85,000. Addition of 2,500-kw. generator to power house. Completion July 1, 1934.

McPherson, Kan.—P.W.A. $211,000. Total expenditure $210,530. Addition of 3,000-kw. turbo-generator to power house. Completion October 1, 1934.

Synthetic Daylight Aids Poor-Vision Pupils

Blended tungsten and mercury light raises tone and efficiency of half-blind school children. Sixteen foot-candles on the desks and 12 on the blackboards.

By W. R. FLOUNDERS
General Electric Vapor Lamp Company, Hoboken, N. J.

Some of Philadelphia's schools have rooms given over to "sight-saving" classes. In these classes are gathered from all over the city children whose eyesight is so poor that they are incapable of carrying on ordinary school work. Here skillful, specially trained, sympathetic teachers are devoting their lives to make it possible for these unfortunates to earn a living in some way and not become a charge for public charity. Many of the children would hold a book printed in extra heavy type within three or four inches of the eyes. Some stood within a foot or two of the blackboard to read figures three inches high made with extra heavy chalk. All pictures on the wall had the important part heavily outlined in India ink. All the desks are easily adjustable and movable, so important is it that the students should be able to use daylight to the best advantage and also to get very near the blackboard or charts which were being studied. In spite of the abundance of window area and good, well-diffused artificial lighting, they were especially irritable on dull or rainy days.

The school authorities recognized the fact that there was much room for improvement in the artificial lighting and were eager to find a solution of this problem. A careful study of the situation indicated that one of the major difficulties was the difference in color between the artificial and the natural lighting. There was a marked tendency on the part of the students to look at the lighting units when they were energized.

Accordingly it was arranged to equip one room on the northeast corner of the building temporarily with a synthetic daylight installation—that is, a unit containing both incandescent and mercury tube lighting properly blended—and study the effect.

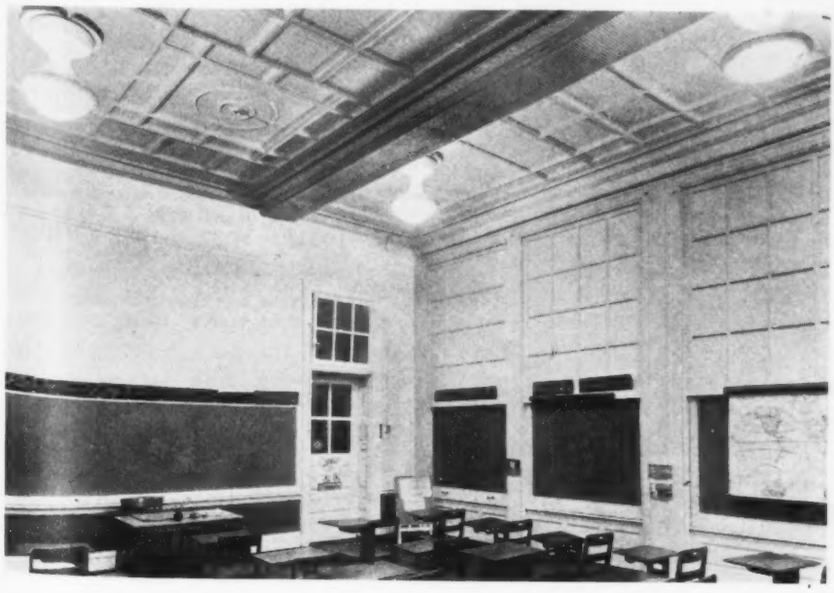
The results of this experiment far exceeded any expectations. The ratio between incandescent and mercury tube lighting was carefully adjusted to blend with natural lighting on an overcast day. When complete it was impossible to tell where daylight left off and artificial lighting began, so closely did one merge into the other. The students were able to see much more easily. In certain cases it was noted that the student held his eyes much farther from the printed page than he had under ordinary lighting. The teachers found their supervision no more difficult on a rainy day than in fair weather. Many educational authorities and experts on this special kind of teaching had an opportunity to study this installation and all voiced approval. It unquestionably had stepped up the seeing power of these unfortunates to a very marked degree. The room is housed in a rather old building and is 24x26 ft. with a 15-ft. ceiling. Windows extend to nearly the entire width of the north side and about two-thirds of the east side.

This lighting installation is significant since it points toward a direction in which future lighting may very well go. The fact that such expert observers as sight-saving class teachers and prominent educational and medical authorities are convinced that in this particular case light that blends with daylight is easier on the nerves with uncorrected light from incandescent equipment indicates that the nerve strain on people with normal eyesight may be greatly lessened by artificial lighting which is corrected in quality and possesses as well the other essentials of good illumination.

A 300-watt circular mercury vapor tube and a 500-watt "Mazda" in combination with auxiliary equipment for the mercury tube located in the receptacle.

Courtesy Voight Company

Mercury and incandescent units in the same luminaire



Poor-vision pupils encouraged by continuous daylight

The synthetic daylight installation consists of four semi-indirect combination lighting fixtures of the ceiling type, each containing one 500-watt "Mazda" lamp and one 300-watt circular mercury tube. The auxiliary equipment for the tube is housed in the canopy. The average illumination on the desk tops is 16 foot-candles, on the blackboards 12 foot-candles. The utilization factor is unusually low due to the high ceiling and the larger percentage of space devoted to blackboards and windows. The distribution of light is unusually uniform.

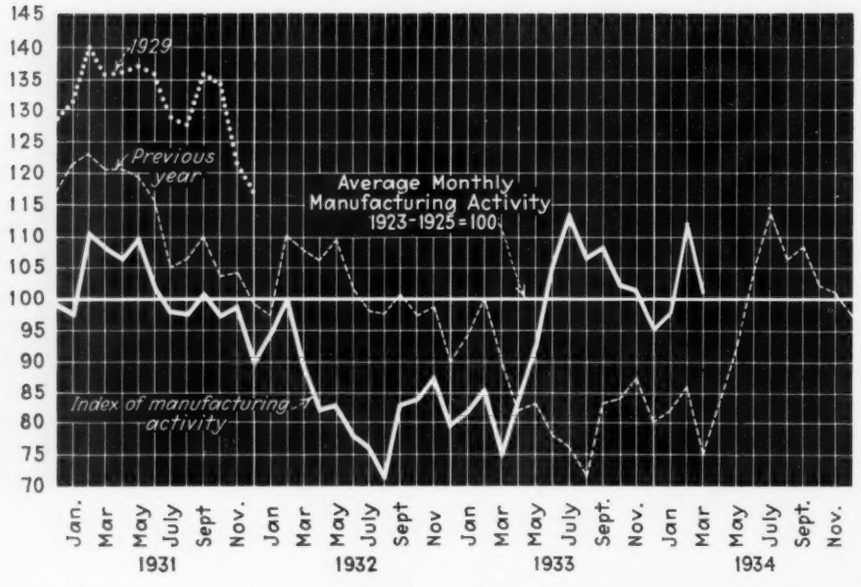
March Factory Energy Far Above 1933

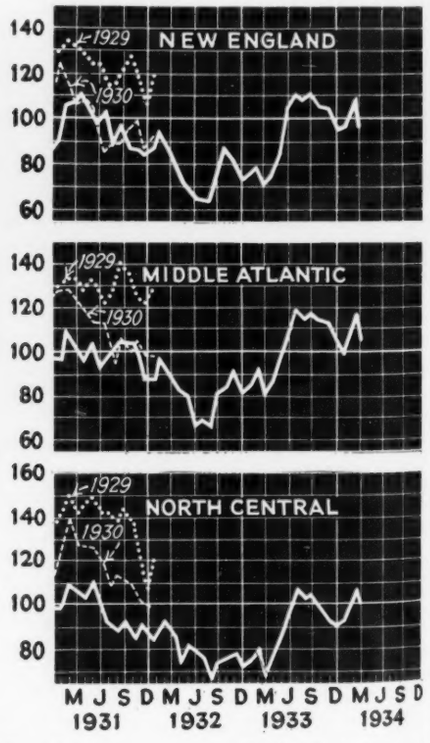
Automobile factories doubled their energy consumption; rubber works likewise. Iron and steel mills using 70 per cent and metal-working plants 62 per cent more than a year ago.

INDUSTRIAL plants of virtually every kind are producing more goods and are using much more energy than at this time a year ago. Considering the latter as a gage of the former, reports received by ELECTRICAL WORLD show an increase of 34 per cent in March of this year over 1933. This statement is based on returns accounting for more than a billion and a quarter kilowatt-hours, equivalent to half the total energy sold by public utilities to wholesale consumers. The year's increase is considerably greater than in other recent months, contrasting with 20 per cent in December, 19 in January and 29 in February. The increase over March, 1932, was 15 per cent.

The gains over the month in 1933 run through all branches of manufacturing except food products, and that industry maintained a relatively high level throughout the depression. Improvements are indicated in capital goods industries by higher figures in iron, metal-working and stone, not only far above last year's March but also over January of this year. Noteworthy advances over the shorter as well as the longer interval in automobiles, rubber and leather products and textiles are evidence of continued expansion in consumer goods.

The attempt to analyze changes from February is hampered by our exasperating calendar, which contains consecutive months differing by 11 per cent in total number of days and by 17 per cent when Sundays and generally observed holidays are omitted. If adjustments are made on the latter basis operations in March were apparently 11 per cent behind those in February, but 4 per cent higher than in January. If differences in the length of the month are ignored, March shows a gain over both preceding months—5.6 per cent over February and 7 per cent over January.





Index of monthly manufacturing activity—Total, North and East

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.

	United States				New England				Middle Atlantic				North Central			
Industrial Groups	Mar., 1934	Feb., 1934	Jan., 1934	Mar., 1933	Mar., 1934	Feb., 1934	Jan., 1934	Mar., 1933	Mar., 1934	Feb., 1934	Jan., 1934	Mar., 1933	Mar., 1934	Feb., 1934	Jan., 1934	Mar. 1933
All Industry	**101.3**	**112.0***	**97.7***	**75.3**	**98.3**	**110.2***	**97.8**	**70.2**	**105.0**	**117.8***	**101.8**	**80.8**	**100.2**	**109.8***	**95.5**	**67.8**
Automobile (incl. parts and accessories)	91.0	95.5	78.9*	42.6	....	....	....	....	82.0	89.2*	72.2	37.1	91.4	96.2	79.0	41.4
Chemical products (incl. oil refining)	141.0	162.8*	147.5	115.6	142.0	172.0	149.4	142.5	151.5	171.3*	157.0	121.7	115.8	145.1	129.2	101.7
Food products	102.0	117.5*	106.0	101.5	....	....	....	....	104.5	122.5*	114.3	107.0	97.8	112.0	98.2	96.2
Iron and steel	86.2	89.3*	76.2	50.5	98.5	114.3	115.3	82.2	80.0	88.0*	71.5	40.8	88.5	87.2	75.7	54.0
Metal working	81.8	88.6	78.7	50.5	108.0	121.1	107.2	64.2	66.3	71.8*	64.3	47.2	94.4	100.2	87.8	50.1
Metals group	83.6	88.9*	77.8	50.5	105.2	119.0	109.4	69.3	72.4	78.8*	67.4	44.5	92.1	95.3*	83.3	51.5
Leather products	100.0	124.3*	89.7	81.4	92.8	112.7*	72.5	69.7	112.7	156.0*	109.2	117.9	92.6	100.2*	85.7	66.8
Forest products	97.1	112.0*	102.9	84.7	48.2	50.2*	46.8	33.2	58.7	67.0*	60.8	56.3	85.8	93.7	86.2	58.4
Paper and pulp	118.3	130.3*	119.8	95.2	118.3	131.7	128.0	90.8	94.0	108.6*	98.4	70.0	101.3	116.4	110.5	97.8
Rubber products	138.2	140.2*	128.6	68.0	112.3	113.7	113.5	65.2	....	....	....	....	146.3	146.2	132.5	67.7
Shipbuilding	84.3	107.6	91.0	71.5	....	....	....	....	....	....	....	....	....	....	....	....
Stone, clay and glass	80.7	88.7*	74.3	68.8	....	....	....	....	58.7	56.3*	41.8	48.6	101.8	121.5	105.0	74.7
Textiles	104.3	119.2*	99.5	79.0	83.5	89.4	79.2	56.5	138.4	158.7*	132.5	108.3	145.0	167.5*	132.5	103.6

*Revision.

The problem is further complicated by code requirements, whereby the permissible number of working days is in many instances made to differ from the corresponding number in other years.

Improvements in East and North

Hit most severely a year ago, the North Central region shows the highest rate of gain, 48 per cent, and a loss, after adjustment, of only 9 per cent from February, while the unadjusted total shows a gain of 7 per cent over February. Automobiles and rubber gained even more in this region than nationally, compared with 1933; iron and steel increased 64 per cent and metal working almost 90 per cent. Among consumer goods leather advanced 39 and textiles 40 per cent. Foods were virtually at last year's level.

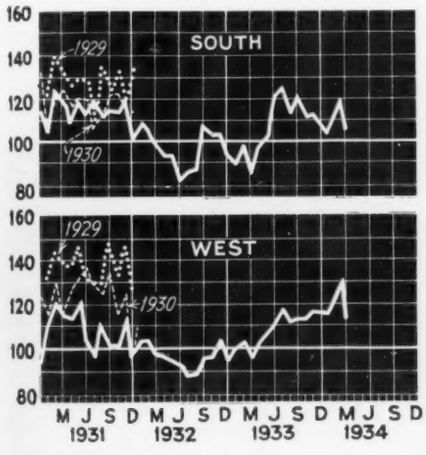
The Middle Atlantic region owes much of its 30 per cent rise to iron and steel, which doubled, to metal working, which gained 40 per cent, and to textiles, about 30 per cent. Energy consumption in automobile plants rose greatly, as elsewhere, but that industry is not of primary importance on the Atlantic seaboard. The improvement in basic industries is again to be noted.

New England as a whole advanced 40 per cent over last year and 4.5 per cent in total over February, which corresponds to a decrease of 11 per cent when both figures are adjusted for an average working month. Textiles, important in this region, were 48 per cent higher than a year ago and metal working, second in importance, 68 per cent. Chemical products remained at the 1933 level. All other groups advanced.

South and West participate

Returns from the South and West are less nearly complete than those for other regions. Those now in hand show gains of 22 and 16 per cent, respectively, over March of last year. In the South the textile industry was at a relatively higher level a year ago than in New England, and now shows a smaller increase, amounting to 20 per cent. Iron and steel, on the contrary, did better in this region than nationally.

In the West gains are evident over last year all along the line except in the stone group, but without exception there were recessions from February, most of them moderate.



Index of monthly manufacturing activity, South and West

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation)

	South				West			
Industrial groups	Mar., 1934	Feb., 1934	Jan., 1934	Mar., 1933	Mar., 1934	Feb., 1934	Jan., 1934	Mar., 1933
All Industry	**105.1**	**120.4***	**103.9**	**85.9**	**111.0**	**126.3***	**118.2**	**95.8**
Chemical products	151.7	178.0*	157.4	124.7	80.0	91.6*	93.0	70.3
Food products	122.7	143.0*	134.0	127.2	112.8	130.1*	121.0	108.3
Iron and steel	131.8	135.7*	135.1	60.3	....	....	....	....
Metal working	89.5	98.5*	85.4	63.6	....	....	....	....
Metals group	113.2	119.3*	113.2	61.8	69.0	74.7*	71.0	45.4
Forest products	43.8	50.3*	39.4	28.4	154.0	177.2*	165.4	136.7
Paper and pulp	155.4	171.3*	152.2	133.5	160.5	161.0	145.6	111.0
Rubber products	95.3	114.8*	106.8	73.0	114.4	117.0	96.8	27.9
Shipbuilding	....	....	....	....	113.0	148.4*	126.8	96.3
Stone, clay and glass	122.0	122.5*	100.4	109.0	105.3	125.0*	117.5	109.3
Textiles	113.4	135.7*	108.0	94.7	....	....	....	....

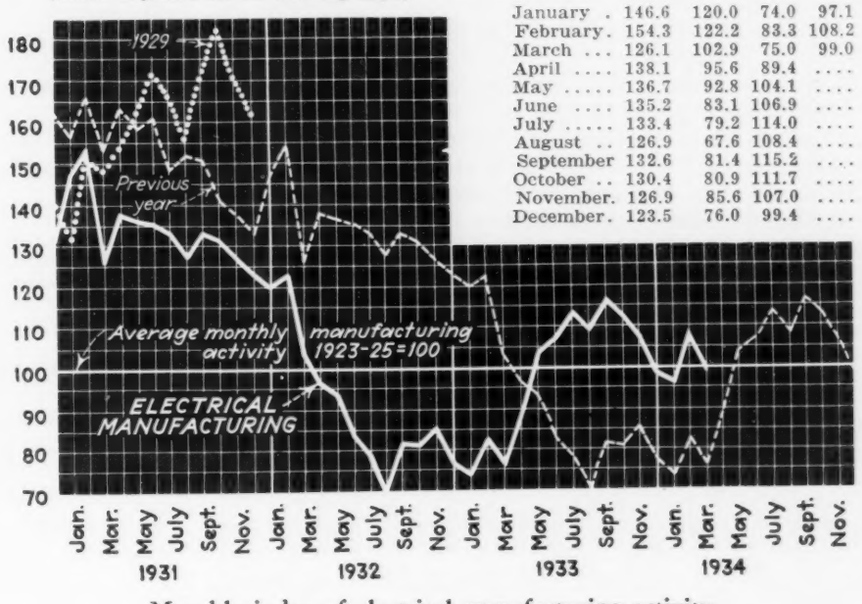
*Revision

Electrical Marches With General Industry

Moving along the same path with the general average of industrial activity, electrical manufacturing plants during March increased their energy consumption 32 per cent over last year, but the daily average decreased by 8 per cent from February. Total operations, however, irrespective of the difference in working days, were 7 per cent greater than in the short month.

This latter advance occurred chiefly in the group of large manufacturers, which increased operations by 15 per cent, proportionate to the longer working month. Diversified smaller companies reported about the same totals as in February, except in the North Central region. Here an increase was indicated averaging 16 per cent, but in the case of at least one appliance manufacturer rising above 50 per cent.

(Index adjusted for 26 working days)



Monthly index of electrical manufacturing activity

	1931	1932	1933	1934
January	146.6	120.0	74.0	97.1
February	154.3	122.2	83.3	108.2
March	126.1	102.9	75.0	99.0
April	138.1	95.6	89.4	....
May	136.7	92.8	104.1	....
June	135.2	83.1	106.9	....
July	133.4	79.2	114.0	....
August	126.9	67.6	108.4	....
September	132.6	81.4	115.2	....
October	130.4	80.9	111.7	....
November	126.9	85.6	107.0	....
December	123.5	76.0	99.4	....

Induction Furnace Energy at Low Cost

By C. M. LAFFOON

Power Engineer
Westinghouse Electric & Manufacturing Company,
East Pittsburgh

With the demand for 5,000-cycle power for induction furnaces steadily increasing the need for the development of efficient generators for such application becomes apparent.

Further advances in the inductor type may involve hydrogen cooling as the easiest way of getting improved efficiency.

Additional economies must come from improved materials and more effective loss dissipation.

INCREASING use of high-frequency induction furnaces for metallurgical applications involving melting and heat treating pure metal, steels and special alloys has brought about the need for giving consideration to the generating unit for supplying the electrical energy. The particular furnaces under consideration utilize single-phase current and voltage the frequency of which is approximately 5,000 cycles per second. It is anticipated at the present time that energy requirements varying from 25 to 500 kw. will be needed in the near future for such furnace applications and that inductor type generators, for motor-generator set conversion from 60 cycles, of multiple construction for higher ratings and hydrogen cooling for improved efficiency will be the best solution.

Under most favorable growth condition, it is expected that the total furnace demand for 5,000-cycle power will probably be so small and its transmission over appreciable distances so difficult that it is impractical to consider direct generation from prime-mover type generating stations. Properties requiring 5,000-cycle induction furnace applications will usually have an adequate 60-cycle energy supply system available, consequently the most logical proposition is to utilize frequency-converting equipment to obtain energy of the desired frequency.

At a frequency of 5,000 cycles the electromagnetic type of rotating generator is the best method available, from the standpoint of cost, maintenance and reliability for supplying the energy. It is apparent from the standpoint of cost and dimensions that the generator should operate at high rotational and peripheral speeds. With the highest rotational speed fixed by the two-pole, 60-cycle induction or synchronous driving motor, the conventional type of generator would require a very large number of field poles in order to deliver approximately 5,000-cycle voltage and current. Since the maximum rotor diameter and peripheral speed are fixed by stress limitations, the maximum value of the rotor pole pitch is on the order of one-half inch. With this magnitude of pole pitch there is insufficient space available for the field pole and its magnetizing winding. The conventional type of electromagnetic generator with a magnetizing winding on each or alternate poles is not considered suitable for frequencies higher than 1,800 to 2,000 cycles per second.

The *inductor* or *change in reluctance* type of electromagnetic generator is more suitable for the generation of 5,000-cycle energy from the structural standpoint on account of the fact that it requires only one-half the number of field poles to produce a given frequency at a given speed, and it does not require any magnetizing windings or collector rings on the rotating element. These conditions permit of making a simple, rugged and very reliable rotor without windings which can be operated at high peripheral speeds, and thus contribute toward a reduction in cost, weight and dimensions of the generator.

The design of a 5,000-cycle inductor type of generator is fundamentally no different from that of a 60-cycle conventional type of electromagnetic generator. However, the actual proportions are materially different because the limitations imposed by the high-frequency pulsations in the magnetizing flux and alterations of the stator current must be met. The two principal differences are in the construction of the stator core and winding. It is necessary to use very thin steel laminations of high silicon content in the stator core, and likewise subdivide the conductors into fine strands and effectively transpose the strands and conductors in order to keep the stator iron and copper losses within tolerable limits. These requirements add appreciably to the cost of the generator on account of the fact that the cost of the laminations, stator winding and assembly labor are roughly inversely proportional to the thickness of the materials.

High loss density requires effective cooling

EVEN though the stator core is built of laminations as thin as is economical and the stator winding effectively stranded and transposed, it is still necessary to work these parts of the magnetic and electric circuits at high loss densities in order further to reduce costs. The high loss densities in turn require more effective heat dissipation to meet standard temperature limits. Air cooling cannot be effectively utilized without making an appreciable sacrifice in dimensions due to the fact that the relatively large total losses are confined to a small volume of material. Water cooling is a most effective means of dissipating the stator copper and iron losses. With the inductor type of generator and magnetizing flux pulsa-

tions and iron losses are confined primarily to the stator teeth. With this type of generator it is thus feasible to provide water-cooling pipes in the stator core and locate them in close proximity to the stator tooth zone to dissipate the stator copper and iron losses. On the basis of the same temperature rise, water cooling of these parts is approximately twice as effective as air cooling, and consequently results in a large reduction in the dimensions and cost of the generator. The copper cooling pipes can serve a further purpose by connecting them together electrically at each end of the core to form a stationary squirrel-cage damper winding. This amortisseur winding will tend to damp out any pulsations in the total value of the magnetizing flux due to the single-phase load.

With the water-cooled stationary element it is only necessary to circulate a sufficient amount of cooling air through the generator to dissipate the rotor windage friction losses. This reduced air volume results in an appreciable reduction in the intensity of the noise emitted from, and the amount of dirt carried into, the generator. If the generator is required to operate in an unfavorable location with respect to dust, dirt and gas fumes it can be totally inclosed and provided with an air cooler so that the cooling air can be recirculated.

Multiple element design gives higher ratings

The general arrangement of the principal elements of the water-cooled 5,000-cycle inductor type generator is shown on the cross-section drawing in Fig. 1. A generating unit of similar design and of 100 kw. rating with shorter rotor and one magnetizing winding has been in service at the copper alloy mill works of the Westinghouse company for twelve years without experiencing a failure of any kind. Two 60-kw., 500-volt, 5,000-cycle, single-phase, 3,600-r.p.m. induction motor-driven generators of similar design have been recently placed in service in an industrial plant. These generators are totally inclosed (Fig. 2). Air coolers are housed inside the stator end bells so that the cooling air for the rotor element can be recirculated, and thus reduce noise and prevent dirt and foreign material being carried into the machine.

Since the total magnetizing flux must pass axially through the rotor body, the maximum rating that can be obtained for a given rotor diameter is fixed by a definite value of the ratio of core length to rotor diameter.

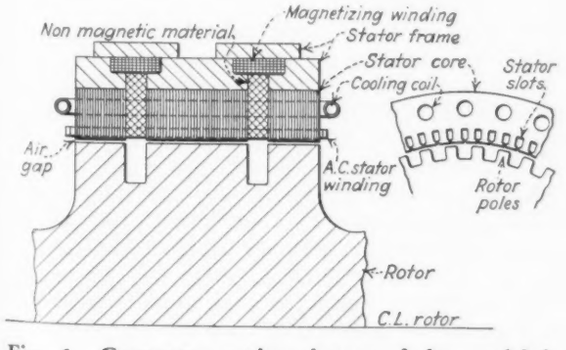


Fig. 1—Generator rating increased by multiple element design

Single-element construction incorporates a shorter rotor and only one magnetizing winding.

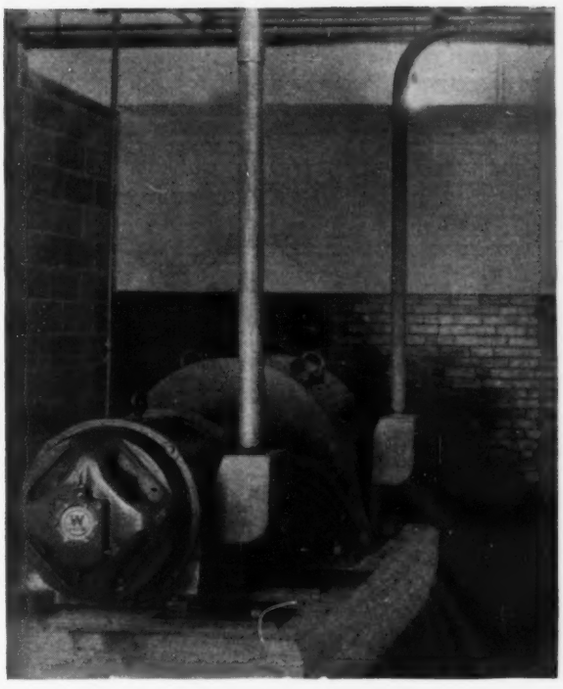


Fig. 2—One of two 60-kw., 5,000-cycle generators in an industrial plant

Both are 500-volt machines serving induction furnaces for small steel parts.

Further increase in rating can be obtained by using the multiple element type of construction, as shown on the cross-section drawing in Fig. 1. With this arrangement there is only one stator winding for the parallel magnetic circuits, and the magnetizing coils can be connected in parallel or series, as determined by particular design conditions. The maximum rating that can be obtained with the multiple-element type of construction is limited only by mechanical considerations, such as rotor deflection, vibration and critical speeds. By utilizing the single and multiple element types of construction it is feasible to cover a wide range of generator ratings with a minimum development expense and manufacturing cost.

Hydrogen cooling raises efficiency

Notwithstanding the fact that only a small number of 5,000-cycle generators have been built during the past few years, appreciable progress has been made in the reduction in size, cost and losses. The high-frequency generator still remains, however, relatively costly and inefficient when compared to 60-cycle generators of modern design. The loss per unit output is necessarily high on account of the high windage losses and the high loss densities in the active portions of the electric and magnetic circuits. The rotor windage and ventilation losses represent an appreciable portion of the total losses. This component can be practically eliminated and the set efficiency increased appreciably by using a cooling medium of low density, such as hydrogen instead of air.

The 60- to 5,000-cycle frequency converting set, consisting of a squirrel-cage induction motor and an inductor generator, is an ideal combination for operation in hydrogen, for there are neither collector rings nor commutators on either element. Both elements can be designed as an integral part of a simple explosion-proof housing,

which can also function as a bedplate support. With the hydrogen cooler located inside the housing, the self-contained unit can be placed at the most economical location, irrespective of surrounding conditions with regard to dirt, dust, moisture and gas fumes. Only simple, rugged and reliable external connections are required for hydrogen, water, electrical energy and simple observation and control elements. The cost of the totally inclosed frequency-converting set should not be appreciably higher when designed for operation with hydrogen and water as the cooling mediums than if designed for a combination of air and water. The over-all efficiency of the set would be increased 10 to 15 per cent and the cost of cooling water reduced 40 to 50 per cent, due to the corresponding reduction in losses. There should be no psychological objection to the use of hydrogen in the frequency-converting unit for the purchasers of such equipment are already experienced with the use of hydrogen in furnace operations. The advantages obtained by using a combination of water and hydrogen in reduction of noise, improvement in efficiency, reduction in operating expense and complete freedom from dirt and foreign material, with consequent operation over long periods of time, are of such importance that serious consideration should be given to its use.

Further economies with respect to costs, dimensions, weights and performance of the 5,000-cycle generator must be obtained from either an improvement in materials or more effective means of dissipating the losses. With respect to the latter, it is encouraging to note that there are attractive opportunities still available.

Compensated Reactors Are Reactive Only Under Faults

English reactors permit higher rupturing capacity with existing switchgear or new equipment of much lower rupturing capacity to be installed. With negligible reactance normally, maximum reactance is attained under faults within 1½ cycles.

Reactors which are said to provide no adverse effect on voltage regulation under normal conditions and which are fused to cut in full reactance upon the occurrence of a fault, so that the kva. ruptured can be safely dealt with by switchgear of rupturing capacity smaller than ordinarily required, have been introduced by the Hackbridge Electric Construction Company, Ltd., Mosley Road, Hersham, Walton-on-Thames. According to the *Electrical Review* the normal reactance rating of the compensated reactor becomes 25 per cent, so that fault current is almost instantaneously limited to about four times full-load current, as compared with ten to twenty times full-load current in the case of straight series reactors chosen for minimum reactance for normal operation.

Under normal operating conditions reactive effect is neutralized by compensating windings. Part of these windings are shunted by a tetrachloride fuse which clears under a fault, upsets the neutralization and inserts the full value of reactance within 1½ cycles. Tests under practical operating conditions have shown that any serious depression of voltage on the side of the reactor remote from the fault is prevented and that the falling out of step of synchronous machinery is avoided. Auxiliary potential windings which are energized by the main flux of the reactor when fault occurs supply the secondary energy for operating tripping circuits, etc. The reactors are built in single- or three-phase units, all in one tank, and transformer type construction with oil-immersed core and coils in sheet-steel tank is employed. The tetrachloride fuses can be changed under load.

Informal opinions on present conditions and problems confronting the industry are helpful. We welcome to this forum the type of discussion presented by Mr. Ferguson and hope others will discuss industry questions here in a similar constructive vein.—EDITORS.

Samuel Ferguson urges—

Safeguards for both customers and profits in the merchandising of standard appliances by utilities

We make a profit in selling all standard appliances which are in popular use, as these articles are sold at list the same as are those of other merchants.

We make a loss on such articles as are still in the promotional stage and have not yet received sufficient popular acceptance as to be capable of being distributed in quantity through regular trade channels; such uses being air conditioning, electric cooking, electric water heating, etc. In promoting these new applications of electricity we spend all the profit received from the standard lines and often more.

Some years ago this promotion work also applied to refrigeration, vacuum cleaners, washing machines, etc., but now that they have received popular acceptance they have moved out of the promotional class into the standard class and are sold only on the same basis as that of other merchants.

The next to move up out of the promotion stage will probably be the electric range, as during the past year the effect of the promotion work of earlier years is beginning to show results in the quite rapid increase in the number of ranges installed by customers.

We are very careful to see that no losses are incurred which will adversely affect the rate to users of electricity in the slightest degree. When losses occur it only means that the company is earning that much less than its legally permissible earnings. But suppose that such losses were a temporary burden on rates, even then the public would be the eventual gainer, as by such promotional efforts the volume of business is so increased as to make further rate reductions possible, and the record shows that rate reductions have followed every material increase in volume of business.

How to Foretell the Returns from Utility Merchandising

Is merchandising profitable?
Is it given the accounting recognition that it deserves?
How should expenses be divided?
Can ensuing revenues be estimated with reasonable accuracy?
Mr. Hussong, with a record of accomplishment, makes some recommendations and proves a case.

By H. O. HUSSONG

Accounting Department, California Oregon Power Company, Medford, Ore.

IT IS within the powers of management to appraise the benefits the utility receives from merchandising and then relate them to the price merchandising costs the utility. When this is done the result is the clearest possible understanding of what merchandising by a utility really means. However, orderly fact-finding procedure to enable management to state definitely whether or not merchandising is profitable is often not provided for in the machinery of an accounting classification.

The primary purpose of an accounting classification may be stated briefly as a program to assist management and regulation in ascertaining whether or not the utility's operations are being carried on prudently and effectively and developed fairly from the standpoint of both the users of utility service and the investing public. If the classification is properly designed, it should prove a useful instrument in studying the result of business operations, but particularly in the case of utility operations it is erroneous to assume that the accounting classification can, of itself, perform the functions or take the place of analytical study and review of operations, without which a fair determination of their advisability is impossible.

This is emphatically true of current merchandise accounting classifications; invariably, charges against receipts from appliance sales include, in some form or another, prorated or allocated amounts for certain classes of expenses arising in related utility departments. Advertising expenses, commercial expenses, superintendence and accounting department expenses are examples of the class of expenses that are ordinarily prorated to the merchandise department. However equitable the bases of allocation or pro rata distribution of expense may be, such bases do not afford an exact standard for the measurement of merchandising results.

Instead of interesting itself in the actual conditions of utility operation, the merchandise department statement of sales and expenses apparently reflects what it might cost an unrelated organization, not engaged or interested in the development of utility service, if it undertook to enter into the intensive sale of load-building appliances and in so doing, to hire, on some undetermined or part-time basis, the executive organization, together with the personnel and facilities customarily employed in ordinary operation by the utility. Such a statement is, therefore, neither fundamentally sound nor of sufficient scope.

Data essential to study

In addition to the customary detailed statement of merchandise sales and expenses, other data necessary for an analytical study of merchandising results should include the following:

(a) Statement of appliances sold in such detail that it is possible to determine, for each class, the net number added to the load and the average size of rating.

(b) Statement of the revenue which it is expected will accrue to the utility through use of the appliance during the lifetime of the appliance in service.

(c) A statement reflecting the operating ratio of the parent utility for the period under study. In combination with the operating ratio it is advantageous to have, also, definite information available as to the percentage of gross revenue appropriated for such fixed charges as general interest, dividends, depreciation, amortization, and like items. These latter ratios may be combined into one total percentage if desired, or stated separately.

(d) In addition to the several work sheets, it is desirable to have at hand information regarding personnel, scope, costs and approximate results of such a promotional department as would be necessary if direct appliance sales were discontinued.

In the study it will be discovered that certain expenditures would be necessary which are charged as merchandise expense, but which would be an addition to operating expense in the absence of a merchandise department. As an illustration of this point, advertising expenses charged as sales expense inevitably, in some degree, would be absorbed in operations, perhaps as new-business department expense. On the other hand, the present advertising budget might be considered in-

adequate under the substitution of abstract, promotional activities for a direct appliance sales campaign. Therefore, some knowledge in this respect is desirable in order that impartial judgment may be used in reaching a decision as to exactly how large a portion of so-called sales expense is really applicable to operations normally carried on by the parent utility.

A procedure for comparing benefits and costs

WITH these data at hand it is comparatively simple to determine what the parent utility is receiving in return for investment in and supervision of an appliance sales department.

The following suggested procedure is logical, continues in related order and requires but little variation in order that it may be suitable for any merchandising set-up.

The first step is to determine, impartially, the actual amount of so-called merchandise sales expense which is inherent to the department as an activity not related to a new-business program; in other words, how much the parent utility is actually "out of pocket" due to merchandising activities.

It is common practice to reflect as merchandise expense such portion of certain joint utility expenses as appear to be equitable. Without raising the question of the fairness of any arbitrary method of allocating the amounts so charged, the first decision must be in regard to the possibility of a reduction in expenditures if the department were discontinued. Examples of the prorated items in which a reduction may, or may not, be expected are stationery, office supplies, rentals, advertising, supervision, superintendence, commercial contracts and collections, bookkeeping, building operation and maintenance, general accounting and reports, etc. The question should arise as to exactly how much savings, if any, would be obtained if a new-business department supplanted the appliance sales department. Again, what savings, if any, would be realized in the absence of either of these activities?

As an example, it may be that the merchandise department is being charged on a floor space basis for rentals. The floor space being utilized is often a portion of a division or district office, occupied under lease. If the utility could effect a reduction in the lease rental costs by discontinuing the merchandise department, that department is properly charged with an amount as rentals. If, on the other hand, no reduction in rentals could be obtained, then the parent utility would be forced to absorb in operations the amount being transferred against the merchandise department. In other words, in such an instance, while for accounting convenience the merchandise department is being charged with rentals and is theoretically liable for a share of the total cost of occupying the building, in actuality the merchandise department is being burdened with a certain amount of expense that would otherwise be a charge against the parent. Hence, such an item is not an out-of-pocket cost of selling appliances and should be stricken from the expense statement before a true footing can be obtained.

When sales expenses and general expenses have been analyzed in this manner a revised statement should be set up, reflecting only such expenses as have been determined to be wholly due to merchandising. If desired, a supplemental column reflecting those items of expense which have been determined to be irreducible, despite a discontinuance of merchandise sales activities, may be shown on the statement.

Merchandising costs may need revision

Before footing the revised statement an analysis of gross merchandise costs should be made in order to determine what, if any, adjustments may be made to general advantage.

Study of several accounting systems discloses the fact that various methods of providing for purchase and warehouse expense are in use. Perhaps the most logical of these is the practice of increasing the original costs of all items purchased by a fixed percentage of the costs, which percentage, translated into dollars, is accrued in a reserve. Against this reserve all purchase and warehouse expense is charged, the materials and supplies naturally being charged to construction and/or operating accounts at the "cost plus" value, thus clearing the materials records.

Under any method of providing for purchase and warehouse expense, there is usually a fixed percentage, or "loading charge," added to the basic costs of appliances and materials purchased for resale. As an example, the total outlay for appliances and materials might be assumed to reach $250,000 per year. Using a nominal rate of 4 per cent for the loading charge, this total outlay would produce a reserve of $10,000 to be consumed solely in purchase and handling of materials and supplies for resale. Hence the amount representing gross merchandise costs as reflected on the income and expense statement would be $260,000, instead of the actual, laid-down cost. No objection should be raised to any equitable way of distributing purchase and warehouse expense. However, the point may be raised that the $10,000 accrued in this manner is more than sufficient to cover all purchase and warehouse expense in connection solely with materials and supplies purchased for resale. If this be true, the merchandise department should be given suitable credit on the revised income statement. If the reverse is true and a savings in purchase and warehouse expense in excess of the amount included in merchandise costs might be obtained by the discontinuance of the merchandise department, then that department is not bearing a proper share of expenses incurred by the parent. In the latter case a debit should be entered against the merchandise department on the revised income statement.

Little agreement on interest accounting

THE item of interest expense appearing on many standard forms used in reporting merchandise department income and expenses is treated variously throughout the industry. In fact, no procedure can be stated as having been accepted as a standard. Perhaps the most equitable of the several practices is entering a charge against the merchandise department as interest, computed at a rate equal to the current cost of money upon the principal amount of all cash advanced to the department. The cash advance may be represented by merchandise stocks, open or contract accounts receivable, bank balances, a combination of these, or any other item or group of items singular to the accounting system of the parent utility. This interest charge appears on the merchandise statement as an expense item. Con-

Statement of Net Return—Merchandise Department

Name of Appliance	Units Sold (Net)	Average Rating (Size)	Consumption Per Year (Kw.-Hr.)	Average Revenue Per Kw.-Hr. (Cents)	Annual Revenue Per Appliance	Total Annual Operating Revenue	Life (Years)	Total Revenue Expectancy During Appliance Life
Cookers—electric	18	450	50	2.50	$1.25	$22.50	10	$225.00
Fans—portable	32	60	32	3.78	1.21	38.72	10	387.20
Grills and table stoves	61	450	50	2.50	1.25	76.25	7	533.75
Heaters—space	42	900	60	2.50	1.50	63.00	7	441.00
Heating pads	14	50	24	3.78	0.91	12.74	5	63.70
Ironing machines	35	1,100	125	2.50	3.13	109.55	10	1,095.50
Irons—domestic	168	550	72	2.50	1.80	302.40	15	4,536.00
Lamps—portable	17	100	12	3.78	0.45	7.65	7	53.55
Lighting fixtures	7	100	24	3.78	0.91	6.37	15	95.55
Percolators and urns	62	450	60	2.50	1.50	93.00	12	1,116.00
Radios	23	100	60	3.78	2.27	52.21	5	261.05
Ranges—electric	241	5,500	1,500	2.50	37.50	9,037.50	15	135,562.50
Refrigerators	118	300	725	2.50	18.13	2,139.34	10	21,393.40
Toasters	88	450	50	2.50	1.25	110.00	7	770.00
Vacuum cleaners	102	160	36	2.50	0.90	91.80	8	734.40
Waffle irons	57	600	24	2.50	0.60	34.20	10	342.00
Washing machines	211	175	24	3.78	0.91	192.01	12	2,304.12
Water heaters	140	Actual	Flat	Flat	33.00	4,620.00	6	27,720.00
Miscellaneous appliances	81	Actual	22	3.78	0.83	67.23	9	605.07
						$17,076.47		$198,239.79

Total operating revenue increases due to sales		$198,239.79
Deduct for revenue not earned during first year—(half of $17,076.47)		8,538.24
Net operating revenue increase due to appliance sales		$189,701.55
Deduct for:		
Operating ratio of parent utility, 50 per cent		$94,850.78
Fixed charges other than interest and dividends, 18 per cent		34,146.28
Interest on average investment in merchandise department ($250,000 at 8 per cent)		20,000.00
Merchandise department loss per adjusted income statement		21,527.49
Total deductions		170,524.55
Remainder		$19,177.00
Net return as interest	8.00%	$20,000.00
Remainder after all charges	7.67%	19,177.00
Total net return during expected appliance life		$39,177.00

currently it appears on the income statement of the parent as an item of miscellaneous revenue or, perhaps, a credit to interest expense, the net result being no change in the consolidated statement. Under this, or similar practice, interest expense should be deleted from the merchandise department income statement. Interest is, however, a proper charge against the merchandise department and will be provided for from another source.

Estimating revenues from appliances

Having completed the revision of the merchandise department income statement, the next step is to determine the scope of results obtained by the merchandising program. This may be obtained from a statement of appliances sold. A columnar statement is most convenient in practice, with columns headed somewhat as follows:

1. Kind of appliance.
2. Quantity of units sold (net).
3. Average rating (size).
4. Average annual consumption per unit.
5. Average revenue received per kilowatt-hour.
6. Average annual revenue per appliance unit sold.
7. Life in service of appliance sold (years).
8. Total revenue expectancy during life of appliance.

Since any analysis of a merchandise department necessarily must deal with an individual organization, it follows that local ratings, life and revenue computations are preferable to national averages, but in the absence of definite data manufacturers' tables are available which afford reasonably accurate statistics upon the lifetime of an appliance in service and average consumption of units of service in the average home. In the larger companies company statistics will ordinarily reflect the average revenue per unit of service sold, classified by customer groupings, and the annual consumption for the different kind of appliances sold. If such information is not available, the basic values may be obtained readily. Using comparable time periods, total revenues divided by total sales in units of service will obtain the average revenue per unit. Annual consumption may be computed by multiplying the average use per time unit by the rating of the appliance or known consumption in any given period of time.

To illustrate the use of the statement of appliances sold, let us assume one sale has been made consisting of an electric range of 5,000-watt rating. Using approximate national averages this range may be expected to utilize 1,500 kw.-hr. of electric energy per year. At a revenue of 2½ cents per kilowatt-hour the total annual revenue expectancy from this range is $37.50. Before computing the total revenue expectancy of this particular range the calculation must be weighed by the time element, since appliance sales are frequently periodic or seasonal in nature. For this reason the revenue calculation should be weighted by the term of average use in that period, for example: The total sales throughout one calendar year might be reflected, conservatively, as producing full revenue for one-half that year, only. Naturally, in the following year, full revenue expectancy is to be reflected and so throughout the life of the appliance in service.

Local conditions must rule

Therefore, an electric range upon the above conditions may be assumed to produce a total revenue during the first year of $18.75, but during an estimated life in service of fifteen years will earn for the parent utility approximately $500. However, in all instances, local conditions should be used when making computations of this nature.

The columnar statement, upon completion, will show

as the footing of the right-hand column a total increase in operating revenue for which the merchandise department alone is responsible.

How to evaluate merchandising

Although an increase in operating revenue is the ultimate aim of merchandising, the total revenue earned during the lifetime use of any appliance sold may not be considered to be net profit nor wholly credited to the merchandise department. Adjustments of this item of increased operating revenues may be made as follows:

Firstly, a deduction by the application of the normal operating ratio of the parent utility for the period under study.

Secondly, an adjustment should be made to reflect payment to the parent utility for interest on the investment in the department, computed at a rate equal to the current cost of money to the utility, or, in lieu, a percentage should be deducted for fixed charges.

Finally, the footings of the revised income statement are to be combined with the adjusted operating revenue expectancy. If the revised income statement indicates an apparent loss the deduction of this "loss" from the net expected revenue will reimburse the utility in full; if the revised statement indicates a profit on merchandise sales the department is entitled to an equal sum as additional earned surplus.

The resultant sum represents a logical measurement of the benefits accruing to the utility through activities of the merchandise department; if a deficit appears, the department has failed to be self-supporting; if, on the other hand, a surplus remains, that surplus is an extra dividend paid to the parent, after provision for all charges. If such a surplus is available the department is, without question, operating on an economically sound basis.

The accompanying statement summarizes an analytical study of an imaginary merchandise department, which study has resulted in a definite evaluation of sales activities.

Comparison of the net return set out on the foregoing statement with what would be the footing of the merchandise income statement of the imaginary department is a startling indication of the ineffectiveness and incompleteness of the ordinary statement. In this example the revised income statement reflected a net loss of approximately $21,500, whereas the study suggests the conclusion that, instead of a loss, the merchandise department actually earned a net profit of approximately $19,000, after all charges. Hence, it is evident that an income statement must be recast and used in combination with co-ordinate factors before final determination of the results of the department can be made.

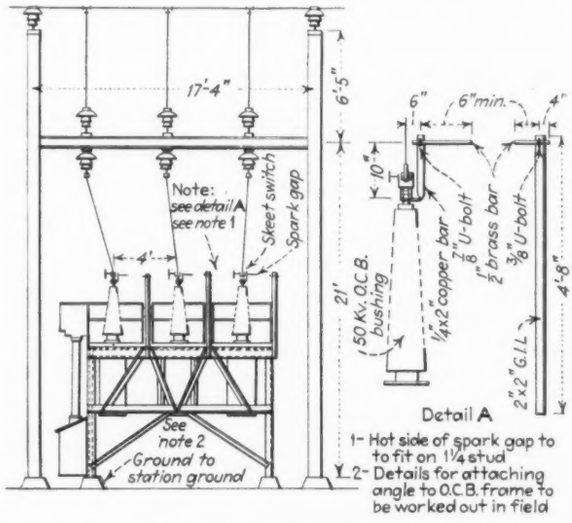
Only by means of periodic analyses, giving due weight to all known elements, is it possible to visualize the full effect attained by a well-founded policy governing appliance sales.

In summation, it is apparent that the measurement of relationship and effectiveness is neither the gross nor net derived from appliance sales alone, but rather the "out-of-pocket" cost the parent compaany can best afford to bear in the acquisition of an added amount in revenues derived from utility services. When management has been furnished with a definite statement of this cost, then, and only then, can the merchandise department be budgeted and controlled.

· · · INDUSTRY

Spark-Gap Protection Limits Breaker Tripouts

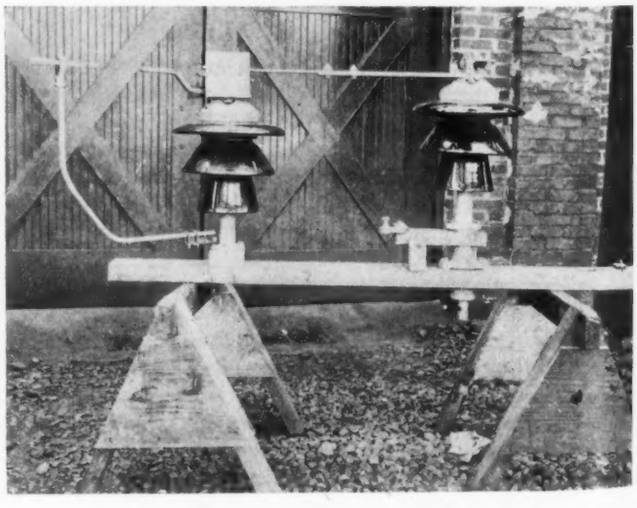
Use of instantaneous reclosing circuit breakers by the Georgia Power Company has made feasible the utilization of dead-grounded spark gaps. These are installed on all power customer substations in conjunction with reclosing breakers and on the line side of quick-reclosing



Sketch for ground gap installation on line side of breaker bushing terminals on 44-kv. substation

breakers on all 44-kv. transmission substations. A heavy copper ground wire from each gap is tied with the station grounding system.

These gaps are set to flash at about 60 per cent of breaker bushing flashover value and have proved to be

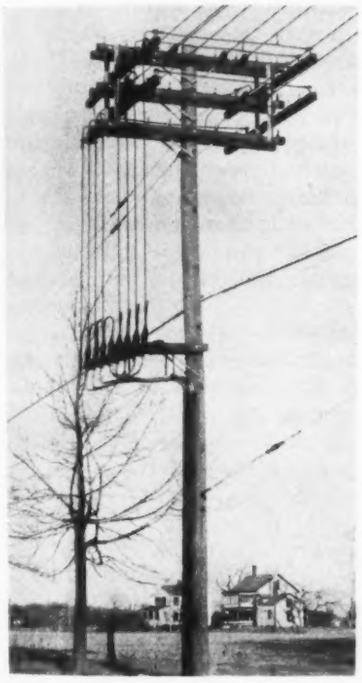


Grounded spark gaps are readily placed on installed equipment

PRACTICES IN BRIEF · · ·

very successful in their protective function without increasing the number of tripouts. They are readily installed and are made in the company shops.

Outrigger Pole Design Aids Joint Junction Clearances



Ample space for both power and telephone linemen characterizes the design of this 40-ft. pole on the outskirts of West Concord, Mass., where two three-phase, four-wire, 4-kv. cables of the Edison Electric Illuminating Company of Boston connect with two overhead circuits in serving the Maynard district from the Concord substation. An aerial cable of the New England Telephone & Telegraph Company uses the pole jointly with the Edison company. The design is featured by a standpipe through which the Edison circuits are brought up from underground conduit to potheads mounted on an outrigger arm providing 4-ft clearance from the pole. The overhead connections between the potheads and the outgoing overhead wires are made by extra heavily insulated wire which is carried to horizontal buses run transversely across the pole structure and from which taps are made to the various phase wires leading off toward Maynard. The standard spacing between crossarm centers is 30 in. and between phase wires on the buses 14 in.

Dual-Motor Drive Permits Two Operating Speeds

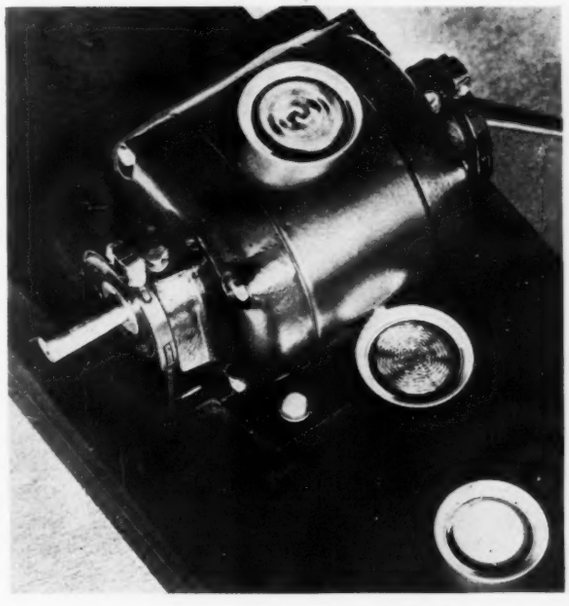
By H. P. ARNOLD
Westinghouse Electric & Manufacturing Company, Providence, R. I.

In a great many industrial applications two definite speeds are necessary, one a low speed for inspection or threading-in purposes and the other for normal production. A simple installation was recently made in a textile plant using a direct-connected motor as the main production drive and a slow-speed gear motor connected by a "free wheeling" clutch which picks up the load when the main supply is shut off for inspection operation. Previously such applications involved the installation of expensive gearing and clutches, adjustable-speed motors, dual-frequency drives, or similar multi-speed devices.

Any speeds can be had by installation of the proper gearing. In this application a machine required a motor rated at 5 hp., 116 r.p.m. during the threading-in period and 25 hp., 1,750 r.p.m. during normal production. Both motors were geared to the intake shaft of the machine, the operating motor with pinion keyed to its shaft, while the slow-speed motor was connected through an overrunning clutch similar to a free-wheeling unit to its pinion. The gear motor is in operation constantly when the machine is in use, and when the operator desires to inspect the operation he merely trips out the 25-hp. drive and the small motor will pick up the load without shock at 116 r.p.m. until operation can be resumed under full normal conditions.

This general scheme is adaptable to such machines as rayon slashers, wire-drawing machines, calendars, cold rolling mills, certain machine tools and other miscellaneous applications.

Rubber Mounting Benefits Shown by Mercury Pools

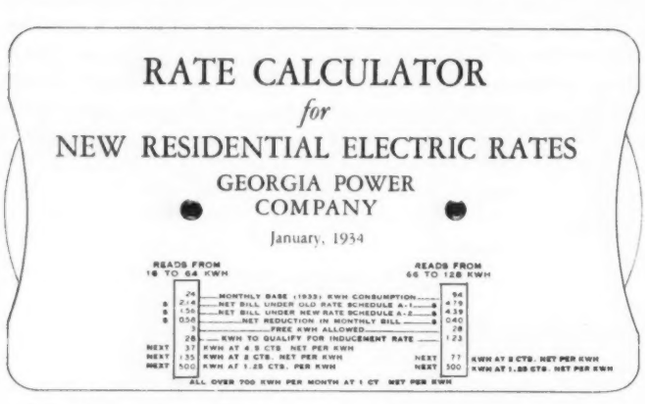


Effectiveness in damping out vibrations of the rubber mountings used by General Electric on its latest appliance motors is shown graphically by three little pools of mercury. The two of the pools fastened to the motor itself show the inherent vibration of the motor, but the third, fastened to board on which the motor is mounted, shows that none of the vibration is transmitted by the rubber mounting due to the absence of standing waves on the pool. This method of showing visually the suppression of vibrations involved was

chosen because the measured amplitude of the vibrations was small and the surface of the mercury is extremely sensitive to disturbances.

Simple Rate Calculator Gives Customer the Facts

Having at the tip of the tongue the degree of change from a former rate is a great asset for utility employees when a new and novel rate is instituted. A quick answer goes far to allay the suspicion that all electric rates are complicated. Georgia Power Company has met


RATE CALCULATOR
for
NEW RESIDENTIAL ELECTRIC RATES
GEORGIA POWER COMPANY
January, 1934
READS FROM 16 TO 64 KWH
READS FROM 66 TO 128 KWH
MONTHLY BASE (1933) KWH CONSUMPTION
NET BILL UNDER OLD RATE SCHEDULE A-1
NET BILL UNDER NEW RATE SCHEDULE A-2
NET REDUCTION IN MONTHLY BILL
FREE KWH ALLOWED
KWH TO QUALIFY FOR INDUCEMENT RATE
NEXT KWH AT 4 CTS. NET PER KWH
NEXT KWH AT 3 CTS. NET PER KWH
NEXT KWH AT 1.25 CTS. PER KWH
NEXT KWH AT 2 CTS. NET PER KWH
NEXT KWH AT 1.25 CTS. NET PER KWH
ALL OVER 700 KWH PER MONTH AT 1 CT. NET PER KWH

Calculator gives all advantages of new rate at a glance

this by providing a sixteen-page intimate primer for the customer and a simple rate calculator for the employees.

In the calculator two disks have the data for any consumption from 16 to 510 kw.-hr. printed radially on them and showing through a window where the items are identified as follows: Monthly base (1933) consumption, net bill under old rate, net bill under new rate, net reduction in monthly bill, free kilowatt-hours allowed, kilowatt-hours to qualify for inducement rate and the rate for follow-on blocks. To economize size and space both faces of the disks are used, affording four ranges of consumption, 16-64, 66-128, 132-270, 280-510.

Fifteen instead of 5 kw.-hr. is given for the dollar minimum bill under the new rate. The service charge was dropped. But most unusual in the new schedule is the provision of bonus packages of "free electricity" for any month in which the consumption shows an increase over the same month of 1933. If all the 108,000 customers take full advantage of this generosity during 1934 the company will have to find an additional 20,000,000 kw.-hr. For the present usage of 60 kw.-hr. per month the bill drops from $3.77 to $3.37, and in addition there is the gift of 11 kw.-hr. if the current consumption exceeds that of a year ago.

Stainless Steel Properties Classified by Groups

In a recent treatise prepared under the direction of the committee of stainless and heat-resisting steels of the subsidiary manufacturing companies of the U. S. Steel Corporation the electrical and other properties and appropriate applications of the USS chromium and chromium-nickel groups are given. All of these alloys are of the relatively low carbon type; the first two are of the chromium alloy group, are paramagnetic (μ = 1.03) and have specific heat of 0.12 cal. /degree C./gm. (0 to 100 deg. C.); the three last compose the chromium-nickel group, are ferromagnetic and have a specific heat of 0.11.

The first type, 18-8, has the widest applicability due to the combination of unusual physical properties with most thorough resistance to corrosive attack. Like the others, it is quite permanently resistive to atmospheric attack and is resistant to many industrial solutions and chemicals. It will maintain strength and resist scale up to 1,600 to 1,650 deg. F. A stabilized 18-8 having carbon less than 0.08 per cent and a stabilizing agent is more resistant to intergranular corrosion, due to carbide formation, in the temperature range 1,000 to 1,600 deg. F.

USS 25-12 is intended for use at high temperatures and will not scale below 2,100 deg. F. USS 12 is similar to early high chromium low carbon steels; it is the only one of the types that is strengthened by conventional oil or air quench from a high temperature. Type 17 has slightly more restricted use than 18-8 and is meant for temperatures up to 1,550 deg. F. USS 27 is primarily for industrial use between 1,500 and 2,100 deg. F. for furnace linings and parts, valves, etc.

In general, these alloys are amenable to almost every process known to the metal worker's art and can be polished to a high luster, mirror surface. They do not respond to ordinary heat treatment, but can be cold worked to greater strength. Annealing to remove cold work effects consists in heating up to some temperature, according to the metal and the use for which intended, and then cooling rapidly. All types can readily be welded by gas or electric methods, with arc or resistance electric welding generally most convenient. For arc welding, coated rods of the same material and the usual spot or seam resistance methods are used. For best results welded articles should be annealed after welding to improve corrosion resistance.

Properties of Stainless and Heat-Resisting Steels

Physical Properties	18–8	25–12	12	17	27
Composition—(per cent)					
Chromium	17–20	22–28	12–14	16–18	25–30
Nickel	8–12	12–16	.....	.....	.....
Manganese	0.50	.....	0.50	0.50	0.50
Silicon	0.75	.....	0.50	0.50	0.50
Carbon	0.15	0.25(Max.)	0.10	0.10	0.10
Specific Electrical Resistance:					
Microhms/in.^{3}	27.6	30.7	22.4	23.2	26.4
Low carbon steel	6.4	7.1	5.2	5.4	6.1
Melting Range (deg. F.)	2,550–2,590	2,530–2,570	2,750–2,790	2,710–2,750	2,710–2,750
Thermal Conductivity:					
Cal./CM.^{3}/Sec./°C./CM., at 100 °C.	0.0390	0.03–0.04	0.0595	0.0583	0.0500
Low carbon steel	0.33	0.25–0.34	0.50	0.49	0.420
Cal./CM.^{3}/Sec./°C./CM., at 500 °C.	0.0515	.....	0.0686	0.0624	0.0583

BOOK REVIEWS

Thermodynamics of Electrical Phenomena in Metals

By P. W. Bridgmen. Published by the Macmillan Company, 69 Fifth Avenue, New York, N. Y. 195 pages, illustrated. Price $3.75.

A large fraction of engineers will remain content to accept as rigorous the principles which they have learned to use in connection with currents in metallic circuits. This book, however, is written for those who are disposed to stay on the querying, skeptical side. Dr. Bridgmen puts many simple electrical phenomena in metals to thermodynamic test and scrutinizes their validity. The Volta, Peltier, Hall, Thomson and other effects run into a slight modicum of insubstantiation when viewed so critically.

Thermionic emission, vapor pressures, crystal-electrics and photoelectrics are also examined by this natural philosopher (in distinction to the mathematical physicist), who strives to rationalize the concepts and reconcile the deviations, using mathematics, true, but philosophizing all the time as to the logic of the mathematical indications. The restless exploratory mind will relish the chance to question even the axiomatic things in metallic conduction and emission.

The Design and Use of Instruments and Accurate Mechanisms

By T. N. Whitehead. Published by the MacMillan Company, 60 Fifth Avenue, New York. 279 pages, illustrated. Price, $3.50.

This is not a book on electrical instruments, on electrical measurements, nor on the academic theory of the probability of error in measurement. But fundamental to all design and use of instruments there must be a practical appreciation of the sources of error so that they may be avoided or circumvented in both the layout of the device and in its use. Mechanisms analyzed include the photomicrometer, accelerometer, assay balance, screw backlash and friction generally, telescope collimator and goniometer. The second half of the book is devoted to kinematic design and is semi-mathematical. A long chapter goes into the planning of an instrument in a most helpful way. Researchers and laboratory technicians are the ones who will want this book.

Centrifugal Pumps, Turbines and Propellers

By Wilhelm Spannhake. Published by the Massachusetts Institute of Technology, Cambridge, Mass. 328 pages, illustrated. Price, $5.

While visiting lecturer at M.I.T. Professor Spannhake established the unity of centrifugal pumps, turbines and propellers by laying their common fundamentals of fluid flow. These have been expanded into this text, which makes notable progress in replacing empiricism with foundation theory. Four parts take up successively hydromechanics, the runner in inclosed and in uninclosed flow, and the modern impulse wheel without attempting to extend the principles evolved into the formalities of design. Two projected volumes will cover irrotational and vortical flow phenomena and the mechanical construction of turbo machines. A unique characteristic of the author is his success in circumventing the coefficients which abound in hydrodynamics; the confusing unit heads and unit velocities are wholly escaped by this technique. Hydraulic engineers generally will get a new and clarified approach to their problems by study of this text.

Power Supply Economics

By Joel D. Justin and William G. Mervine. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. 225 pages, illustrated. Price, $3.50.

A thorough treatise on the technical and economic features of power supply. It covers available sources of power, load studies and predictions, available fuels, steam plants, steam plant economics, cost of steam power, hydro power in all aspects, peak load plants, interconnection, oil engine power, industrial power plants and purchased industrial power. The approach is based upon relative costs and advantages and disadvantages from an economic point of view. Technical design and details of assembly are not treated. This is a very fine discussion of the present economic aspects of power production.

You Must Relax

By Edmund Jacobson, M. D. Published by the McGraw-Hill Book Company, 330 West 42d Street, New York, N. Y. 201 pages, illustrated. Price, $1.50.

Insulation against nervous high tension is as difficult for the electrical T.B.M. as for any others. Reduction in voltage is the answer and Dr. Jacobson tells how thus to counteract supersynchronous living. Objective relaxation first demands awareness of the muscular and nervous tension. Excellent illustrations show the methodical approach to detection of these local tensions and thence, step by step, to conscious relaxation. Millionthvolt apparatus confirms the author's neurological technique and many case citations show the results in practice. This is essentially a self-help book for the incipient nervous wreck who is tempted to shunt relaxation aside and go in for a series of excitement escapes when the opposite is his single best bet—it even tells how to relax at work!

Technische Messungen

Technical Measurements

By A. Gramberg. Published by Julius Springer, Berlin W9. Linkstrasse 23-24. 488 pages, 395 illustrations. Price, 24.00 reichsmarks.

In general plan this book, now in its sixth edition, revised and modernized, classifies measurements in terms of quantities to be measured, devoting a chapter to each kind: Pressure, time and speed, mass and volume, temperature, quantity of heat, calorimetry of fuels, gas analysis. Force, torque, work and efficiency have a separate chapter; so has the indicator. It includes sections on servo-motor methods for operating instruments and on the transformation of measurements to electrical counterparts for remote indication.

The treatment of the subject is essentially descriptive; demands on the user's mathematical knowledge are moderate. The book will interest electrical engineers whose duties call for familiarity with related fields.

NEWS OF THE WEEK

Eleven Appliance Makers Approved by E.H.F.A.

Eleven manufacturing companies have been approved by the Electric Home and Farm Authority to manufacture electric ranges, water heaters and refrigerators for sale in the Tennessee Valley, according to a statement made at the authority office in Chattanooga last week. The authority is planning to co-ordinate its advertising with that of the manufacturers and advertising programs are now under discussion.

The companies whose products have been approved include the Westinghouse Electric & Manufacturing Company, Edison General Electric Appliance Company, Landers, Frary & Clark, McGraw Electric Company, Kelvinator Corporation, Estate Stove Company, A-B Stove Company, A. J. Lindemann & Hooverson Company, Cleveland Heater Company and the Malleable Iron Range Company.

Approved appliances will carry a distinguishing mark of the authority and will be sold through regular dealer outlets. They will be financed upon term payments by the Electric Home and Farm Authority, with co-operation of the private utility companies operating in the areas designated.

Steel Engineers Seek New Methods

A. I. & S. E. E. discusses the technical features of electric furnaces, specific types and performance data, as well as the present and expected trends in types adapted to fit production.

MARKED by wide interest in new methods, new operating economies and in new equipment to do industrial jobs more quickly and more economically, the spring engineering conference of the Association of Iron and Steel Electrical Engineers, under the auspices of the Combustion Engineering Division, was held in Youngstown, Ohio, April 11 and 12. The conference was attended by more than 700 persons. Steel mill engineers were uniformly enthusiastic over the immediate outlook for business activity in their respective fields, as has been the case at other general meetings in the Middle West area. The settlement of the Detroit automobile strike situation appears to have pretty well cleared the air of all but third and fourth grade industrial disputes in the area and released an appreciable amount of prospective business.

At the first session discussion of purely electrical methods to the solution of present-day metallurgical problems indicated sustained improvement in energy-handling technique. At this session three papers were presented on electric furnaces by well-qualified men and the attendance was the best of the conference. The papers of the second day's sessions dealt with steel mill technique and refractories and were of interest to electrical men only in so far as they might help in design and maintenance of furnaces.

Electric furnaces superior

Wirt S. Scott, as special representative of the Westinghouse Electric & Manufacturing Company, Mansfield, Ohio, discussed the temperature distribution of electric and fuel-fired furnaces. He emphasized the necessity of uniform temperature distribution in production furnaces that the same results can be given the product as were produced in the small laboratory furnaces, where test specimens can be located nearer to the controlling thermocouples. He pointed out that close temperature regulation throughout the charge can be obtained with electric furnaces and urged that the value of this in improved product be adequately considered in terms of dollars and cents when selecting furnace equipment. A paper by A. N. Otis of the industrial engineering department of the General Electric Company, Schenectady, tied in with Mr. Scott's fundamental arguments. Mr. Otis discussed the types of electric furnaces adapted to the box annealing of sheets in protective atmospheres and presented curves and data to show the temperature distribution obtainable throughout a stack of sheets. He also discussed types of furnaces adapted to box annealing of coils of wide strip and presented data on output and expected economies with furnaces of this type requiring no cover hoods or retorts.

A joint paper by T. B. Bechel and M. H. Mawhinney of the Electric Furnace Company, Salem, Ohio, pointed out the advantages of multiple batch furnaces in line, with proper handling equipment, which should appeal to steel mill engineers for use in handling awkward and unwieldy products.

Eight Utility Measures Await Lehman Approval

In a capitulation as decisive as it was unexpected, the New York Assembly this week passed five of the "Lehman utility reform" bills, bringing to a legislative conclusion eight of the eleven measures comprising the program. With as many as 45 of the 85 Republican Assemblymen joining with the entire Democratic side of the House, little of the objection expected was evinced against the program.

Included in the measures now before the Governor for signature is the municipal ownership bill, which was passed by the Assembly after amendments which would require a Public Service Commission certificate of necessity had been defeated. The other four bills approved by the Legislature this week provide for turning over of customers' deposits with utility companies to the state treasury after such deposits have remained unclaimed for fifteen years; appropriation of a $300,000 revolving fund for the Public Service Commission to defray the cost of rate investigations, the ultimate cost to be assessed against the utility immediately concerned; requirement of Public Service Commission consent for use of revenues by any utility for other than operating expenses, maintenance, payment of indebtedness with interest and dividends to stockholders, and permission to villages which have their own gas and electric plants to furnish service in outlying territory, subject to approval at a referendum.

Key measure still unvoted

The three remaining bills which await legislative action include the key measure which would empower the Public Service Commission to order temporary rate reductions to a point where a utility corporation would earn not less than 5 per cent on its property used or useful in the public service, less depreciation. This measure, now in the Assembly rules committee, is expected to be reported out for a vote within a few days. Senate action is still required on the Buckley bill, which requires public letting of all contracts by public utility corporations where the amount involved exceeds $25,000 in one year.

Supreme Court Upholds Nebraska Power Districts

Action in quo warranto brought by a landowner in the Loup River valley to settle possible defects in the Nebraska law, enabling the creation of public power and irrigation districts and empowering them to borrow funds from the federal government (ELECTRICAL WORLD, April 14, page 561), has been dismissed by the state supreme court in a decision which removes the last legal obstacle to the Sutherland and Columbus power and power-irrigation projects. The court held against the relator on every point.

To the argument that no power or method was provided for requiring the district to charge adequate rates, thus making possible bond interest defaults, the court replied that this omission may have a tendency to affect the market for the bonds but does not affect the validity of the act. Whether the legislation is wise or unwise, whether the enterprise is profitable or unprofitable, was a matter for the consideration of the legislature, with which the courts have no concern.

It was also held that the legislation did not provide for taking of private property without due compensation, and hence was not violative of the constitution, and the fact that the district has no funds with which to pay for property condemned does not invalidate the law since owners of lands are protected by the constitution from any taking of their property without due process of law and payment of just compensation.

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Utility Tax in New York?

Legislative authority to revive the 1½ per cent tax on the gross monthly incomes of public utility companies is being sought by Mayor LaGuardia of New York in a new tax program formulated with the purpose of enabling the city to take the final step in wiping out its budget deficit. Originally imposed last September 1 as an emergency measure, the tax expired February 28. It was estimated to have yielded $8,300,000 for the six-month period.

Outside Meters Planned

In order to speed up meter reading, save householders the annoyance of having meter readers entering the house and incidentally to make it more difficult for unscrupulous consumers to tamper with the meter, the Columbus (O.) Railway, Power & Light Company is planning to make every electric meter in the city an outdoor installation. Certain legal obstacles must first be removed, however. Under the provisions of a recently enacted city ordinance requiring that all electrical installation work be done by licensed contractors the utility company is not permitted to make the wiring changes entailed in moving the meters. City Council will be asked by the City Board of Examiners for Electrical Contractors to amend the ordinance.

Los Angeles Contemplates Frequency Changeover

Los Angeles Bureau of Power & Light is considering the possibility of a complete changeover from 50 to 60 cycles, according to a statement made recently by E. F. Scattergood, chief engineer and general manager, before leaving for Washington to confer with the Reclamation Bureau. The change is being considered in anticipation of distribution of power from Boulder Dam, which will be available late in 1935. Generating equipment for the dam ordered thus far has been designed for operation at either 50 or 60 cycles and bids on transformers called for alternative proposals on both frequencies. Equipment in the bureau's own plants is also designed to operate at either frequency.

Representatives of various electrical companies have been in southern California for some time advising with engineers of the bureau on the costs and problems relative to the change. Tentative estimates place the cost at about $2,500,000, with the major difficulties involving the change of synchronous equipment.

Range Rentals Offered by Kansas City P. & L.

Launching what it terms "the greatest merchandise campaign in its history," Kansas City Power & Light Company last week announced a plan for rental and easy purchase of ranges and water heaters. Two range models and a 50-gal. tank water heater are offered on an optional trial or purchase plan.

A new off-peak water heating rate of 1 cent per kilowatt-hour preceded the opening of the range and water heater plan. A three-surface unit range rents for $1.25 per month or sells for $1.75 monthly. A larger model, with four units, rents for $1.50 per month and sells for $2.

Canadian G. E. Contract

Contract for the supply of switchboards in connection with the $310,000 power plant now being installed at St. Hyacinthe, Quebec, has been awarded to the Canadian General Electric Company, Ltd.

LIGHTING OF BLOSSOMS LIVENS FAMILIAR SIGHT

Wide World

Washington's classic springtime spectacle, Japanese cherry blossom time, which yearly brings delight to thousands, has been made even more effective this year under a newly installed lighting system. Visitors are thus enabled to enjoy impressions of the blossoms at night together with those of the illuminated Washington monument and the lagoon.

Coming Meetings

Electrochemical Society — Asheville, N. C., April 26-28. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Atlantic City, N. J., May 14-18. A. R. Small, 109 Leonard St., New York.

American Institute of Electrical Engineers—Northeastern District meeting, Worcester, Mass., May 16-18. Summer convention, Hot Springs, Va., June 25-29. H. H. Henline, 33 W. 39th St., New York.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., May 21-24. A. W. Berresford, 155 East 44th St., New York.

Edison Electric Institute—Atlantic City, N. J., June 4-7. B. F. Weadock, 429 Lexington Ave., New York.

Canadian Electrical Association—Annual convention, Seigniory Club, P.Q. (Lucerne-in-Quebec). June 13-15, B. C. Fairchild, 409 Power Building, Montreal, Que.

American Society of Mechanical Engineers—Semi-annual meeting, Denver, Col., June 25-28. Calvin W. Rice, 29 W. 39th St., New York.

Winnipeg Electric Offers Properties to City

On the condition that the purchasing price be based upon fair value or fixed by arbitration, Edward Anderson, president of the Winnipeg Electric Company, has officially offered to sell to the city all the assets of the company and its subsidiaries. A statement to this effect was issued last week after a meeting of the joint sub-committee dealing with the controversy between the city and the company resulting from the complicated problems which are facing the Manitoba utilities. Last fall the company defaulted on its 5 per cent refunding mortgage stock and 6 per cent refunding mortgage bonds, stating that resources were inadequate for requirements (ELECTRICAL WORLD, September 23, page 391).

Mr. Anderson's offer was contained in a letter addressed to Premier Bracken, who called the meeting. The view was expressed following the meeting that the city would not consider arbitration, but that it probably would be willing to set out the factors that should be taken into consideration in fixing a fair value for the property.

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Salmon River Case Closed

Fifteen years of litigation, costing both parties between $300,000 and $400,000, have been settled out of court in the Salmon River water power cases of Perry W. Chace and Fannie L. Horton of Altmar and the Niagara, Lockport & Ontario Power Corporation, a subsidiary of the Niagara Hudson Power Corporation. The amount paid for the Horton interests, including settlement of five mortgages, was $344,000. Disposition of the Horton case gives the power company property and river rights from Redfield to the mouth of Salmon River at Lake Ontario. Whether the Niagara interests have other plans for further development of the projects in Oswego County was not disclosed. The company has five planned but undeveloped projects along the Salmon River in addition to the Bennetts Bridge and Lighthouse Hill plants, in operation and turning out about 70,000 hp.

South Carolina Passes Santee-Cooper Bill

Final form of the bill authorizing the Santee-Cooper project as passed by the South Carolina legislature and signed by Governor Blackwood last week provides that seven members of the South Carolina Public Service Authority, which is to have charge of the development, be elected by the General Assembly. The project involves the construction of a low diversion dam, about 30,000 feet long, located thirteen miles north of St. Stephens on the Santee River; a second and higher dam, about 7,000 feet long near Moncks Corner on the old Santee-Cooper canal; the creation of two great lakes, one having a surface area of 78,000 acres and the other 59,000 acres; construction of two short canals; construction of a two-lift lock and a 200,000 hp. hydro-electric plant and substation near Moncks Corner, and building of 75 miles of transmission lines to serve the market in the coastal region and to interconnect with transmission lines serving other parts of the state.

The legislature also adopted a resolution directing the State Railroad Commission to report to the 1935 legislative session property valuations of Associated Gas & Electric subsidiaries in the state. Senator Williams of Aiken said its adoption was necessary to obtain lower rural rates from private companies.

Canadian municipal bill shelved

Premier Taschereau's bill to authorize the municipalization of electricity in the province of Quebec has been shelved for the time being. The measure has been sent to the Public Bills Committee, there to lie until the end of the present session of the legislature, when it will automatically die. The government may reintroduce it next session.

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Appliance Sales Control

An ordinance regulating the sale of electrical devices and appliances in Los Angeles, Calif., has been adopted by the City Council and forwarded to Mayor Frank L. Shaw for approval or veto. The ordinance, according to the city building and safety commission, is designed to prevent the "dumping" of inferior goods, which cannot pass inspection. Oriental goods of this type, according to a statement to the City Council, have not the durability of standard appliances and are a fire hazard. Under the ordinance, all electrical goods must pass an examination, but those bearing the stamp of approval of a national electrical underwriters' association are deemed satisfactory. Others must be submitted to the department of building and safety for tests, the cost of which will range from $10 to $25.

Neon Code Gets Hearing

Public hearings on a code of fair competition for the electric and neon sign industry will be held in Washington beginning April 23, the National Recovery Administration has announced. The code is sponsored by the National Electric Sign Association, claiming to represent 52 per cent of the industry. A maximum work week of 40 hours, with variations for cities of smaller population, and a minimum wage of $16 per week are established under the proposed code.

MERRY-GO-ROUND

Before determining upon a plan for the conduct of its census of rates charged for electricity, the Federal Power Commission has planned a series of conferences, first with the representatives of municipal and public agencies interested and then with the representatives of the private power companies. It is expected that a considerable amount of the material needed can be secured from the public service commissions in the various states. Producers of electricity and others interested will be consulted in determining just what information will be of most value.

After eight months spent in assembling a staff and in making an inventory of available state and federal data, the Federal Power Commission is now ready to proceed with its general power survey. Enough samples have been taken here and there to indicate the fundamental lines which this survey will follow.

Despite face-saving talk, it is quite apparent that Congress intends to make substantial modifications in the securities act and to strip the Stock Exchange bill of many of the prescriptions for registering securities, for requiring information, for limitation on buying and selling, to say nothing of the provisions applying to "controlling persons." Legislation having no immediate bearing on the matter of credit expansion, it seems likely, will be handled as separate legislation at the next session of Congress.

PAUL WOOTON,
Washington Correspondent.

12% Output Rise Shown by Geological Survey

Accelerated gains in the output of energy by public utility plants are shown by figures announced by the United States Geological Survey. February production of 7,057,435,000 kw.-hr. was 12 per cent more than in 1933, whereas the year's rise in January was 10 and in December 4 per cent. Average daily output rose 2.4 per cent over January, in contrast with the usual slight decrease, and 4 per cent over February, 1932. Recent monthly totals have been slightly revised as follows (in millions of kw.-hr.): December, 7,470; January, 7,629.

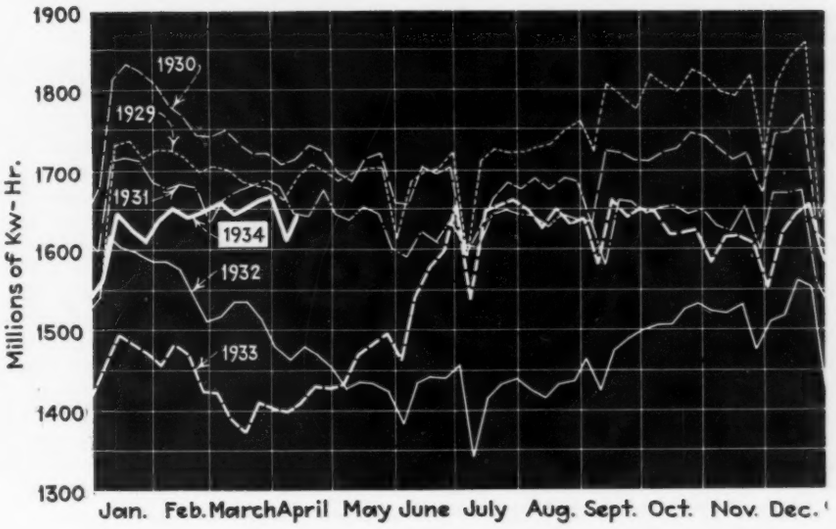
The average daily production from water power was 14 per cent less in February than in January. To balance this decrease and take care of the larger total, there was a corresponding increase of 13 per cent in energy generated from fuel and of 14 per cent in coal consumption.

Division	Nov.	Dec.	Jan.	Feb.
United States ..	+ 4	+ 4	+10	+12
New England	+ 7	+10	+16	+22
Middle Atlantic ..	+ 6	+ 2	+ 9	+14
East No. Central.	+ 8	+10	+18	+21
West No. Central.	+ 3	— 1	— 5	+ 1
South Atlantic ...	— 9	+ 1	+ 4	0
East So. Central..	— 5	— 6	+18	+19
West So. Central.	+ 2	+ 3	+12	+ 5
Mountain	+25	+18	+20	+14
Pacific	+ 3	+ 4	+ 4	+ 8

The survey figures differ from those announced for central stations alone by the Edison Electric Institute and ELECTRICAL WORLD because of the inclusion of railway and other plants contributing to the public supply.

Changes in per cent from the preceding year's figures for equivalent months are shown by geographic divisions in the accompanying table.

Energy Output Turns Upward



Once more increasing in opposition to the usual spring-time trend, electrical energy production in the week ended April 14 amounted to 1,642,187,000 kw.-hr., according to the Edison Electric Institute. The excess over the week of last year increased to 16.5 per cent, despite the advance which was just then setting in. Over 1932 the gain was 11 per cent; 1931 was virtually matched. Only 1929 and 1930 remain to be surpassed, and the margin is but 4 per cent.

Industrial energy use is surging upward. Industries are not merely holding their own. They have speeded up. No other explanation can account for the rising output in the face of diminished lighting as the days lengthen.

In the Central industrial region the great lead continues, now 22.4 per cent over 1933. New England and the Middle Atlantic region are holding steady, the Pacific rising, the Mountain gradually moderating.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Apr. 14...1,642	Apr. 15...1,410	Apr. 16...1,481
Apr. 7...1,617	Apr. 8...1,399	Apr. 9...1,465
Mar. 31...1,666	Apr. 1...1,402	Apr. 2...1,480
Mar. 24...1,658	Mar. 25...1,410	Mar. 26...1,515
Mar. 17...1,650	Mar. 18...1,375	Mar. 19...1,538

Per Cent Change from Previous Year

Region	Week ended Apr. 14	Apr. 7	Mar. 31
New England.....	+16.5	+16.0	+17.3
Middle Atlantic....	+12.5	+10.5	+14.4
Central Industrial..	+22.4	+21.3	+27.4
West Central.....	+10.2	+11.0	+10.5
Southern States....	+15.5	+14.3	+17.2
Rocky Mountain...	+16.8	+20.8	+22.1
Pacific Coast.....	+14.3	+12.9	+12.7
United States....	+16.5	+15.5	+18.8

Steam Plant Addition Costs Only $43 a Kw.

So little work remains to complete the 7,500-kw. addition to the steam generating plant of the Taunton, Mass., municipal light board, referred to in the ELECTRICAL WORLD, April 22, 1933, page 503, that it is certain that the cost of this extension will not exceed $43 per kilowatt. The new boiler, turbine and auxiliaries are now in service and construction is being carried out to provide combined steam and electric service to some fourteen industrial plants within a half-mile radius of the station by next fall. The development of the station and enlargement of its service to the mills in the neighborhood, as well as provision for future growth, are being made by Arthur L. Nelson Engineers, Boston, consultants for the department.

Fixed charges on the plant when operating at full load will slightly exceed 1 mill per kilowatt-hour at the bus, and when operating on a full condensing basis the over-all performance is a little under 16,000 B.t.u. per kilowatt-hour. The present system load factor is 46 per cent. The plant will operate on a 10,000 B.t.u. per kilowatt-hour basis when furnishing maximum steam extraction from the new unit to the industrial steam supply system.

Converters for Russia

Construction has been completed by the Compagnia Generale di Elettricità of Milan, Italy, of six converter groups capable of 2,000 kw. output at 3,000 volts d.c. for the Soviet Government. They will be installed in three substations on the Suram railway in Transcaucasia. Each converter group is made up of a 2,150 kw., 6,300 volt, three-phase motor running at 600 r.p.m., which is direct connected to two 1,000 kw., 1,500 volt d.c. generators, one on each side. The generators are connected in series to give 2,000 kw. at 3,000 volts; they are designed to withstand an overload of 50 per cent for two hours and 200 per cent for five minutes.

Sludge Gas Produces Power

Due to the success of its operations in converting sludge gas into electric power in connection with a sewage disposal plant, the Birmingham, Tame and Rea, England, Drainage Board, has decided to increase its plant's capacity by adding an additional 540-hp. engine, together with generator and necessary adjuncts. Beginning six years ago with an engine of 150 hp., the plant has been increased to six times its original size, and net savings during the period have been approximately $67,080, as compared with previous methods.

As to Rates——

• Northern States Power Company has announced a new schedule of electric rates whereby the larger residential users of electricity will be enabled to use more current at no greater cost. The household where the monthly electric bill runs around $5 to $6 will be given a saving under the new schedule. The saving becomes effective after the use of approximately 135 kw.-hr., the first three steps in the residential rate remaining the same. Above this consumption the rate on the next 200 kw.-hr. is reduced from 3 to 2 cents and in excess of this amount the rate is reduced from 3 to 1.5 cents. The company is not making any general reduction, but is offering revisions that will encourage greater use of electricity for cooking, water heating and auxiliary heating of rooms.

• Kansas Electric Power Company has filed a new schedule combining lighting, cooking and water heating rates so that all will be billed at the same rate when the householder owns the proper equipment. This rate provides a minimum of $2.50 a month, for which the customer will receive 35 kw.-hr. of electric power. For the next 65 kw.-hr. the rate is 4 cents an hour, and for the excess above 100 kw.-hr. used each month the rate is 2 cents.

• Western Light & Power Company, Salina, Kan., has established a new rate schedule, combining residence lighting and cooking. Where both services are measured on the same meter the top step is reduced from 12½ to 10 cents. The new schedule also reduces the other steps so that the combination rate approximates the cost for the same amount of service by natural gas. The new schedule also reduces the minimum bills by $1 a month.

• Kansas City Power & Light Company has filed a new schedule with the state Corporation Commission, reducing the minimum charge for water heating service in five eastern counties. The company already has in effect a low rate for water heating and the new schedule provides that the customer may install a unit one-third larger without increasing the monthly minimum bill.

• Appalachian Electric Power Company, which serves portions of Virginia, West Virginia and Kentucky, has been ordered by the West Virginia Public Service Commission to file an inventory of all its property in West Virginia as of March 31, 1934. An investigation of rates charged by the Wheeling Electric Company was ordered at the same time. Both the Appalachian and the Wheeling Electric are American Gas & Electric Company subsidiaries. Similar action was taken in the case of the Federal Public Service Corporation of West Virginia, which serves a number of small towns in the southern part of the state.

• Indiana Service Corporation has been ordered to reduce its electric rates approximately 10 per cent in a group of northern Indiana towns which it serves. The order was issued by the Public Service Commission, which at the same time approved other rate reductions made voluntarily by the company.

• Los Angeles, Calif., Bureau of Power & Light's three new rate schedules, established with the recommendation of the Board of Water and Power Commissioners, has been approved by the City Council in an ordinance recently adopted. If the ordinance is signed by Mayor Frank L. Shaw the new rates will become effective June 1. A new monthly domestic rate schedule, designed to encourage the use of appliances, will scale the cost of service downward from 4.8 cents per kilowatt-hour to 1½ cents, instead of from 4.8 cents to 2 cents. The ½ cent per kilowatt-hour reduction is effective after 175 have been used. Water heater service will be furnished at a rate of 1 cent per kilowatt-hour. A new schedule for the so-called basic industries, ranging between 4½ and 5 mills per kilowatt-hour and in some cases during off-peak periods as low as 2½ mills per kilowatt-hour, likewise is established.

Municipal Items

YUMA, ARIZ.—City recently canceled the proposed $300,000 municipal ownership bond election and voted to accept the 28 per cent reduction in electricity rates ordered by the State Corporation Commission. The bonds were proposed in order to obtain a federal loan of $300,000 with which to finance the construction of a municipal power plant and distribution system. The Arizona Edison Company serves Yuma.

MITCHELL, NEB.—At a recent election voters directed Council to enter into a contract for purchase of current from the federal reclamation project. At Lyman, also in the North Platte Valley, voters gave similar authority. Mitchell recently took over by condemnation proceedings the city distribution system of the Western Public Service Company.

ST. PAUL, MINN. — Characterizing the issuance of permits to Northern States Power Company to operate another year in lieu of a franchise (ELECTRICAL WORLD, April 7, page 523) as a "gross betrayal of the public's interest," Mayor William Mahoney recently vetoed the permit ordinances. City Council deferred action on the veto. Permits would allow continued operation of the company under present rates until January 1, 1935, unless a franchise containing different rate schedules is approved by the citizens.

EL CENTRO, CALIF.—Imperial Irrigation District has closed a contract with the Hooven, Owens, Rentschler Company for the erection of a 3,000-kw. Diesel-electric generating plant at a price of approximately $400,000. In explanation of the move directors of the district stated that the plant is to provide stand-by service to be utilized in connection with hydro plants to be erected on the All-American Canal at a later date.

Power Sales Not Taxable

Interpreting the intent of the Michigan sales tax law as not to include taxation of "sales of tools, materials, supplies and power" used in manufacture of tangible personal property destined for resale, Judge Guy A. Miller in Circuit Court recently handed down a decision relieving many Michigan companies of the 3 per cent sales tax and empowering the Detroit Edison Company to recover $87,000 it has paid into the state treasury.

Maryland Plants Sold

Purchase by the Potomac Edison Company of the electric plants in Lonaconing, Midland, Antietam and Emmitsburg from the Maryland Light & Power Company for $520,000 has been authorized by the state Public Service Commission. Potomac Edison Company was also authorized to buy from the Harpers Ferry Electric Light & Power Company its property on the Maryland side of the Potomac River for $150,000, plus the cost of net additions.

Flint Wants Street Rent

First of Michigan municipalities to follow the example of Detroit in charging utilities rental for the use of city streets (ELECTRICAL WORLD, March 24, page 452) is Flint, Mich., whose city commission recently, by a unanimous vote, ordered Consumers Power Company and Michigan Bell Telephone Company to pay the city for the use of its streets for lines, mains and conduits. The Council action was taken following a report of the Mayor that neither company had reduced rates during the depression and that under the power company's franchise no arbitration of rates could be forced by the city before 1937.

FINANCIAL · · · BUSINESS

G. E. Profits Increase as Billings Rise 35%

Earnings of the General Electric Company in the first three months of this year were equal to 14 cents a share on the common stock, against 8 cents in the same 1933 period, Gerard Swope, president, told stockholders this week at their annual meeting. Profit available for dividends for the quarter was $4,566,000, compared with a 1933 first quarter profit of $2,839,000, an increase of 61 per cent. Earnings on the common were 14 cents also for the last quarter of 1933.

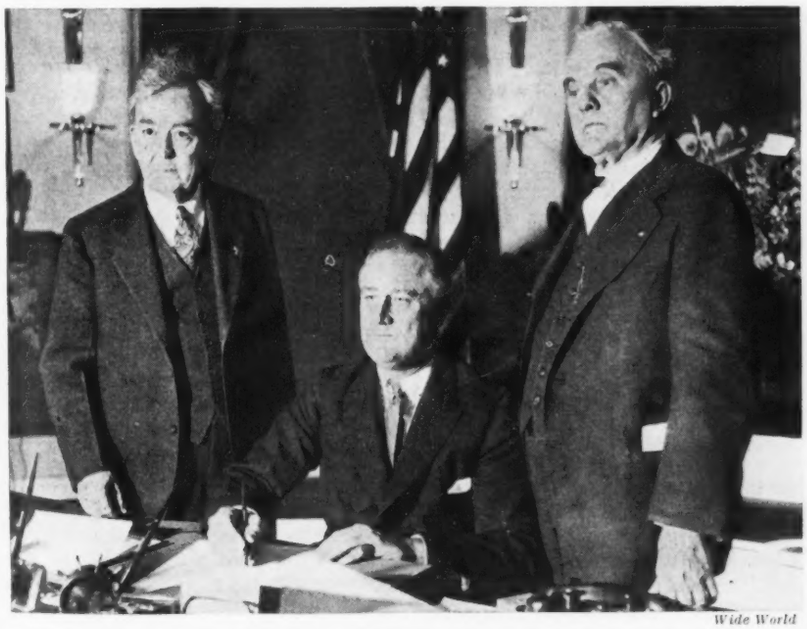
Sales billed for the three-month period amounted to $34,936,000, which, compared with $26,101,000 for the same quarter a year ago, showed an increase of 35 per cent.

Associated Write-Ups Charged by Commission

Following its disclosure of correspondence between Associated Gas & Electric Company executives and several members of the New York Legislature which resulted in a vote of approval by the New York State Senate of a state-wide utility investigation, the Federal Trade Commission continued its hearings on the Associated System. Judson C. Dickerman, commission investigator, charged that write-ups on the value of Associated Gas property were made by Edward J. Cheney, consulting engineer, supposedly an independent appraiser, but actually connected with the utility system. Mr. Dickerman's charge related particularly to the valuation of the Broad River Power Company, a South Carolina subsidiary, but Robert E. Healy, commission counsel, said Mr. Cheney's appraisals were widespread throughout the Associated Gas & Electric Company's system.

The write-ups charged against Mr. Cheney in connection with the Broad River Company ranged as high as 112 per cent, Mr. Dickerman said. The total property of the company was valued at $31,268,124 as of December 31, 1930, by the Cheney appraisal. In the account of electric fixed capital, valued at $26,292,269, Mr. Dickerman cited an appraisal by another firm which indicated a write-up of $9,803,000, or 53 per cent over the cost as figured by Broad River. The commission investigator said the company had inflated its capital and depressed its net earnings. Earnings actually were greater than appeared, he said, because the capital was "supposititious."

NATIONAL RATE STUDY AUTHORIZED



Wide World

With the signing by President Roosevelt on April 14 of the Rankin-Norris resolution the Federal Power Commission was directed by law to investigate and compile data of rates charged energy consumers throughout the nation. The bill passed the House without amendment in the previous week ("Electrical World," April 7, 1934, page 522). The sponsors of the resolution are shown with the President as he signed the bill, Representative John E. Rankin on his right and Senator George W. Norris ("Father of Muscle Shoals") on his left.

GAINING AGAIN

Reversing the declining tendency which crept into last week's business telltales, current guides to industry activity point hopefully upward once more. Energy output for the week ending April 14 regained half of the losses of the previous week. Steel production at the highest levels since August, 1933, stood at 52 per cent of capacity. Automobile output rose despite labor troubles. Carloadings, off sharply, offered the major discord; the loss was largely in bituminous coal loadings.

Prices rallied and weakened alternately in security markets; commodity levels broke sharply early in the week.

Nothing spectacular foreseen for the weeks immediately ahead so far as volume gains are concerned, but the inflation leaven is still working and will be further felt later on.

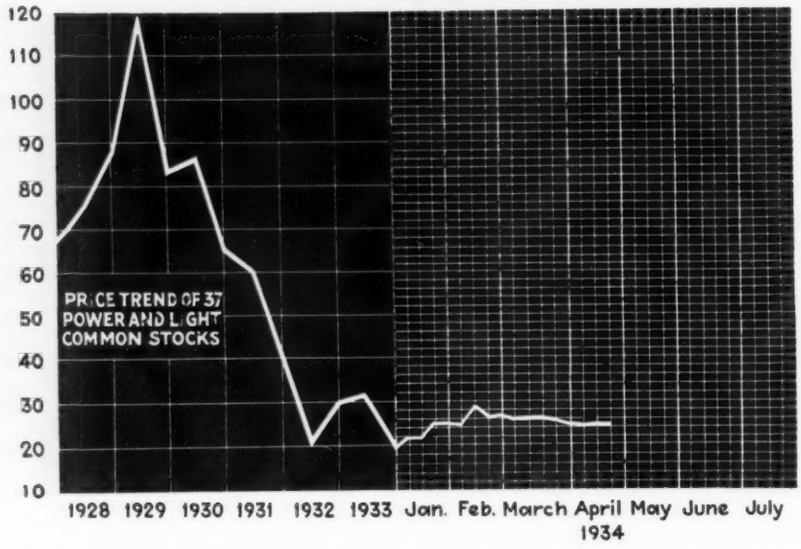
1933 Britain's Bad Year

With the characterization of 1933 as one of the worst periods in the history of the industry, the British Electrical and Allied Manufacturers' Association, in a report just issued, stated that although there was an improvement in the demand for small turbines and transformers, the decline in the market for heavy electrical equipment was substantial. The most buoyant section was that producing meters, wiring and domestic appliances. The year ended, however, with a far more promising outlook for the industry. M. J. Railing, chairman of the council of the B.E.A.M.A., looks to railroad electrification projects abroad to provide the heavy section of the industry with considerable work in the future.

Fort Peck 287-Mile Line

Contract for the construction of one of the longest high-power electric lines in the country, from Great Falls, Mont., to the site of the Fort Peck Dam, was let last week to the Ziebarth-Walker Construction Company of Los Angeles at a bid of approximately $1,100,000. The line will be 287 miles long and will transmit 50,000 kw. Electricity will be carried from the Montana Power Company plant at Great Falls for use in operating four electric dredges and other equipment at the dam site. Construction work will begin within the next week.

Stocks Move in Narrow Range



With the fate of the stock exchange regulatory bill still undetermined, securities moved with lessened activity during the week. "Electrical World" index remained unchanged, 25.2.

New Utility Listings Increase in 1934

Of the 92 effective registration statements filed with the Federal Trade Commission for the first quarter of 1934, and totaling $164,922,002, proposed electric power, gas and water company issues amounted to $30,000,000, or 18.2 per cent of the total for the quarter. Both the number and value of the first quarter issues were lower than the last quarter of 1933, the commission disclosed. Reorganization securities are not included in these totals.

Manufacturing industries accounted for $23,339,389 in the first quarter of 1934, representing 15 per cent of the total, as compared with approximately 30 per cent in the last quarter of 1933. The distribution of total gross proceeds according to the type of registration shows that the manufacturing industries were second in the last quarter of 1933, but yielded that place in the first quarter of the current year to the electric, power, gas and water companies, whose volume of securities increased from $8,750,000, or 4.9 per cent of the total, in the last quarter of 1933 to $30,000,000, or 18.2 per cent of the total, in the first quarter of 1934.

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Seattle Municipal Bonds

Purchase of a $5,000,000 bond issue of the Seattle Municipal Light & Power Company has been concluded by a syndicate comprising the Bancamerica-Blair Corporation, the Central Republic Company of Chicago and Drumheller, Ehrlichman & White of Seattle. A major banking group is being formed to market the bonds. The proceeds will enable the city to complete the last units of its Skagit River hydro-electric development.

Cooley Furnace Licensed

Appointment of the Cooley Electric Furnace Company of Indianapolis as the exclusive licensee of Wild-Barfield Electric Furnaces, Ltd., of London, England, has been announced. The Cooley company will manufacture and sell the patented forced air circulation tempering furnaces and automatic charge progress recording process of steel tempering of the British firm. These furnaces will be equipped in this country with the Cooley Doreco heating elements.

Texas-Louisiana Plans

A reorganization plan for the Texas-Louisiana Power Company, in receivership, was submitted to bondholders this week by a protective committee. Under the plan holders of the present first mortgage bonds would get 50 per cent of their present holdings in new first mortgage 25-year 5 per cent sinking fund bonds and, based on participation in the plan, about 85 per cent of the common stock of the new company, the remaining 15 per cent going to junior creditors. Common stock would be deposited under a voting trust agreement. The plan has been filed with the federal court at Fort Worth, Tex.

Equipment Makers Show 4.4% Net Loss on Sales

Although manufacturing industries as a whole earned slightly less than one cent per dollar of sales in 1933, the electrical equipment industry lost 4.4 cents per dollar of its products sold, according to an analysis of the reports of 240 companies made by the National City Bank of New York. Eight electrical manufacturers reported a deficit of $12,051,000 on sales totaling $297,276,000.

The loss on sales for electrical equipment manufacturers was second only to that of the iron and steel industry, which showed a deficit per dollar of sales of 6.9 cents. Best net profits were shown by cotton mills, drug and sundry manufacturers and shoe producers, who averaged net profits of approximately 7 per cent on sales.

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McGraw Electric Sales Up

As an indication of improved business conditions, the McGraw Electric Company, Chicago, reports that March sales were 309 per cent of the same month a year ago. Each month since last June to the present showed a substantial increase over the same month of the previous year, preliminary estimates indicating net earnings for the twelve-month period ended March 31 will approximate $1 per share. Net profit for the year 1933 after taxes, depreciation and other charges totaled $105,550, equal to 44 cents a share on 236,396 $5 par shares outstanding, excluding 13,604 shares in treasury, contrasted with net loss of $269,124 in 1932.

Construction Awards Rise

For the first quarter of 1934 contracts for construction of all descriptions totaled $462,341,500, as contrasted with only $196,026,800 in the corresponding quarter of 1933, according to F. W. Dodge Corporation. For residential building the gain over 1933 to date amounted to approximately 46 per cent; for non-residential building the increase was almost 85 per cent; for public works the 1934 volume was more than 3½ times the size of the 1933 total; while for public utilities the first quarter's total was about 2½ times as great as in the corresponding period of 1933. March contracts for construction of all descriptions amounted to $179,161,500, a figure representing twice the total reported for February and three times the volume of March, 1933.

Frigidaire House Sales 164% Over Year Ago

A sales increase in every classification of the business of Frigidaire Corporation during March, was reported this week by E. G. Biechler, president and general manager. Household refrigerator sales to purchasers were 432 per cent higher in March than in February and 164 per cent higher than in March of last year. This tremendous sales gain, Mr. Biechler said, proves the better financial condition of families that is being registered in every section of the country, in both urban and industrial localities.

Sales of refrigerating equipment to retailers of foods and beverages, to ice cream retailers and to business concerns requiring water-cooling facilities increased 71 per cent in comparison with the same 30-day period a year ago. Even sale of equipment for apartment houses, a source of business that has been dormant for several years because of the cessation of building activities, showed an increase.

Profits Down in 1933 for Thomson-Houston, Ltd.

British Thomson-Houston Company reports a decline in profits, after income tax, from £392,015 ($1,960,075) to £256,949 ($1,284,745) for 1933. Interest charges and depreciation absorb materially less than last year. The directors, however, have been unable to recommend a dividend on the ordinary shares (against 4 per cent for 1932), the balance forward, after meeting the preference dividend, being slightly higher at £229,443 against £227,795. The ordinary shares are all held by Associated Electrical Industries, Ltd. The balance sheet shows floating assets at a total of £3,536,490, against current liabilities of £904,262, including reserves for contingencies.

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Exposition in Denver

Expanding its usual annual state-wide gathering to include the states of New Mexico and Wyoming, the Electrical League of Colorado will join with the Rocky Mountain Electrical Association in presenting an all-industry conference sales rally and electrical exposition in Denver, April 23-26. The electrical exhibit will be novel in the history of this territory, including many new appliances and equipment and departures in the application of electrical energy.

Crocker-Wheeler Loss Cut

For the quarter ended March 31, Crocker-Wheeler Electric Manufacturing Company reports net loss after taxes, depreciation, amortization and other charges of $8,094, comparing with a net loss of $68,866 in the first quarter of 1933.

Neon Airport Lighting Gets Washington Approval

Adequate and economical lighting of airports with portable battery neon lights is forecast by the announcement that such lights have been sanctioned by the Aeronautics branch of the Department of Commerce. Neon flashing lights have been approved for use as boundary, runway and obstruction lights and are said to be able to function at between 55 and 60 flashes per minute at a cost of one to two cents a day with battery charging only every six months.

Their visibility has been shown to be adequate by tests of the Bureau of Standards and Aeronautics branches of the Department of Commerce and they are unaffected by line storm troubles. Lights are not electrically interconnected, so storms would not put all lights out of commission at one time.

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Amertran Expands Line

Permission to manufacture and sell luminous tube transformers under a non-exclusive license has been granted the American Transformer Company, Newark, N. J., by the Jefferson Electric Company, Bellwood, Ill., which holds certain patents on construction improvements. This addition to the Amertran line is in accord with its current expansion program, company officials stated.

Mid-West Safety Mark Set

Ten out of fifteen electrical apparatus manufacturers in Michigan, Illinois, Minnesota and Wisconsin established perfect records in a no-accident contest recently conducted by the Employers Mutual Liability Insurance Company of Wausau, Wis. The contest included 1,160 companies, representing 51 industries in the four states. Workers in electrical apparatus manufacturing plants competed in efforts to reduce accidents in their plants for the seven-month period beginning June 1, 1933, and ending December 31. Workers in fifteen electrical apparatus manufacturing plants put in 1,167,427 man-hours during the seven-month period. Nineteen accidents occurred, giving the industry a final frequency of 16.4 accidents per million man-hours worked.

Major New Construction This Week

Transformers and accessory equipment, regulators, power feeders and other equipment will be purchased for new power substation for mining service by Yuba Consolidated Gold Fields, Inc., Hammonton, Calif. Cost about $65,000.

Motors and controls, conveyors, etc., will be installed in new food products packing plant addition of Kroger Grocery & Baking Company, Cincinnati, Ohio. Cost about $500,000.

Fort Thomas, Ky., plans early call for bids for new city-owned electric light and power plant and distribution system. Fund of $250,000 is being arranged.

Flint Hill Brewing Company, Flint, Mich., plans new plant. Cost about $100,000, with equipment.

Until April 25, Bureau of Water and Power, Los Angeles, Calif., asks bids for 25,873 ft. 750,000-circ.mil, lead-covered cable and for 12,800 ft. No. 12, A.W.G., lead-covered cable (Specification 1388).

O'Shaughnessy Brothers, Lawrenceburg, Ind., plan new multi-unit distilling plant, including power house. Cost over $125,000.

Potomac Electric Power Company, Washington, D. C., has plans for new power substation. Cost about $50,000, with equipment.

Balboa Brewing Company, San Diego, Calif., plans new multi-unit plant, including improvements in present buildings. Cost close to $100,000.

Motors and controls, conveyors, regulators and other equipment will be installed in new multi-story plant addition of A. H. Lewis Medicine Company, St. Louis, Mo. Cost over $100,000.

Board of Greenwood County Commissioners, Greenwood, S. C., plans new hydro-electric generating plant on Saluda River, vicinity of Chappells, S. C., with transmission lines in different parts of county and power substations for distribution. A $1,000,000 project. Financing is being arranged.

Motors and controls, regulators, conveyors and other equipment will be installed for expansion and improvements at plant of Lockheed Aircraft Corporation, Burbank, Calif. Company is disposing of new stock issue of $250,000, considerable part of fund to be used for purpose noted.

Wellman, Iowa, has rejected bids recently received for equipment for new city-owned electric light and power plant, including Diesel engine-generator and accessories and distribution lines. Proposed to ask new bids at later date. Fund of $85,000 has been arranged for work.

New York Metal Prices

	Apr. 11, 1934 Cents per Pound	Apr. 17, 1934 Cents per Pound
Copper, electrolytic	8.375	8.50
Lead, Am. S. & R. price	4.25	4.25
Antimony	7.95	7.95
Nickel ingot	35.00	35.00
Zinc, spot	4.75	4.75
Tin, Straits	56.35	55.00
Aluminum, 99 per cent.	23.30	23.30

MEN OF THE INDUSTRY

HARRY J. BAUER, president of the Southern California Edison Company, has been elected a director of the Pacific Mutual Life Insurance Company of Los Angeles.

H. H. ADAMS, assistant to Morse DellPlain, president, has been elected a member of the board of directors of the Gary (Ind.) Heat, Light & Water Company to succeed the late William A. Sauer.

MATTHEW S. SLOAN, formerly president of the New York Edison Company and affiliated companies, has been named chairman of the board of the Missouri-Kansas-Texas Railroad. Mr. Sloan became a member of the board of directors of "Katy" a year ago and has also been a member of the executive committee since that time.

DONALD R. DOHNER, formerly director of art in the engineering department of the Westinghouse Electric & Manufacturing Company, and Alexander J. Kostellow, professor of industrial design, Carnegie Institute of Technology, have established offices in Pittsburgh, where they will carry on an industrial design and research service.

WILLIAM H. TANGEMAN, connected with the Hot Point plant of the General Electric Company at Ontario, Calif., for the past fourteen years, has been named executive head of the plant to succeed the late Earl H. Richardson. Mr. Tangeman has served as head of the engineering department of the plant and was superintendent under Mr. Richardson.

SAMUEL G. HIBBEN, director of lighting of the Westinghouse Lamp Company, will sail on the *S.S. Manhattan*, April 25, to lecture in England and subsequently to make an extended tour of the Continent to study European lighting progress. While in Europe Mr. Hibben will make an extended inspection trip of the sodium and mercury-vapor lamp installations in England, Germany, Belgium, Holland and France. He will also accumulate performance and cost data on industrial and commercial installations abroad.

DAVID ADAMS has been appointed Pittsburgh district sales manager of the Falk Corporation, Milwaukee, to succeed W. O. Beyer, who recently resigned to become a member of the Pittsburgh Civil Service Commission. Mr. Adams has been with the Falk Corporation for the past four years in the sales department at Milwaukee and previously had been with National Malleable & Steel Castings Company, Sharon, Pa., and W. A. Riddell Company, Bucyrus, Ohio, in charge of foundry and sales. He was graduated from Rensselaer Polytechnic Institute in 1914.

C. S. Reed Assumes New Executive Duties

C. S. Reed, who has been connected with the Southern Public Utilities Company, Charlotte, N. C., as consultant engineer for the past five years, has discontinued his private practice to join the staff of

that utility as a vice-president. Mr. Reed brings to his new executive position an intimate knowledge of the company's affairs, obtained during the five years he acted in a consultant capacity. A native of Pittsburgh, he was graduated from the University of Pittsburgh in 1911 and obtained his early experience with the Doherty interests, which he served for fifteen years in various sections of the country.

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BATT L. SPAIN, who has been for the past 24 years with the General Electric Company at the West Lynn works as manager of turbo-blower sales, is now connected with Ingersoll-Rand Company as manager of the turbo-blower department, with headquarters in New York. The occasion for the transfer of Mr. Spain is the acquisition of the turbo-blower business of General Electric by the Ingersoll-Rand Company.

CHARLES W. BURROUGHS has recently been appointed district manager of the Montreal office of the English Electric Company of Canada, Ltd. Mr. Burroughs is well known to electrical and mechanical engineers in Canada and the United States, particularly for his achievements in developing the high-pressure steam generator which bears his name. It was in 1925 that he attracted the attention of power plant engineers, when he put into successful operation at the Redpath sugar refinery two high-pressure steam generators of his own invention.

BERNARD P. SHEARON, secretary-treasurer of the United Indiana Public Service Company, Hammond, Ind., has been elected a director to succeed the late William A. Sauer.

J. A. FREEMAN, who has been connected with the Public Service Company of Colorado, Denver, for eight years, has been appointed district manager at Idaho Springs, filling the vacancy caused by the death of C. J. Hancock.

W. R. CHAWNER, for the last fourteen years power sales engineer of the Southern Sierras Power Company at Riverside, Calif., has resigned to take the position of general manager of the Temescal Water Company, at Corona, Calif.

J. D. ROSS, superintendent of lighting, Seattle, Wash., has been called to Washington, D. C., by the Federal Trade Commission to assist in a nation-wide power survey it is conducting. Mayor John F. Dore has granted him a leave of absence.

C. E. SKINNER, assistant director of engineering, Westinghouse Electric & Manufacturing Company, has been elected a vice-president of the American Association for the Advancement of Science and chosen chairman of its engineering section.

C. N. ROBINSON, formerly in the power sales department of the Public Service Company of Northern Illinois, has become manager of the new-business department of the Central Illinois Public Service Company, with headquarters at Springfield.

OBITUARY

D. H. CANTRELL, attorney, of Little Rock, Ark., and formerly president of the Little Rock Railway & Electric Company, died April 4 in Washington, D. C. At the time of his death Mr. Cantrell was a director of the Arkansas Power & Light Company.

MINOR M. DAVIS, retired electrical engineer and traffic manager for the Postal Telegraph Company, died at his home in North Chatham, Mass., April 13, in his seventy-sixth year. Shortly after the World War he severed his connection with the Postal, with which he had been associated since its organization. In its interests he traveled

throughout the United States. Mr. Davis was a fellow of the American Institute of Electrical Engineers.

F. Paul Anderson, dean of the College of Engineering at the University of Kentucky since 1917 and nationally known in the development of heating and ventilating engineering, died April 8, after a long illness, of cancer. He was 67 years of age. As director of the research laboratory of the American Society of Heating and Ventilating Engineers, of which he was a past-president, he directed the preparation of 62 scientific papers pertaining to air-conditioning, heating and ventilating. For three years he was a member of the engineering division of the National Research Council.

George A. Littell, 85, consulting engineer of Potsdam, N. Y., died at his home in that village recently. Mr. Littell was an instructor in engineering for several years at Clarkson College and later on the staff of University of Delaware. He also served many years ago as superintendent of the Potsdam electric light and water plant.

Clarence P. Bradley, president of the Bradley & Hubbard Manufacturing Company, Meriden, Conn., manufacturer of electric light fixtures, died at his home in that city March 9. The company he headed was established in 1854 by his father, the late N. L. Bradley, and Walter Hubbard. Mr. Bradley was 71 years of age.

William T. Baker, president and a member of the board of directors of the Utica (N. Y.) Gas & Electric Company, died at his home in Utica April 9 at the age of 89. In addition to his connection with the public utility industry, Mr. Baker was well known in the publishing field as owner of the Utica *Saturday Globe*. Among the other business enterprises with which he was identified was the Utica Knitting Company in the capacity of president.

Samuel M. Green, one of the most distinguished consulting engineers in the New England area, died at his home in Springfield, Mass., recently, after a long illness. He was born at Benton Harbor, Mich., in 1864; was educated at the Worcester Polytechnic Institute, and in the course of his career served as engineer and architect for many buildings, industrial and particularly chemical plants, with a practice extending to Europe and Australia.

G. Herbert Condict, consulting engineer and pioneer in the development of electrical transportation, died April 9 at his winter residence in Orlando, Fla., at the age of 72. In the course of his career Mr. Condict erected power houses, machine shops and mechanical handling plants and installed machinery and power apparatus for experimental, operating and manufacturing purposes and designed and manufactured electrical and mechanical appliances for power, railways and industrial plants. Executive positions held by Mr. Condict included those of general manager of the Electric Car Company of America, chief engineer of the Electric Vehicle Company, vice-president and general manager of the Electro Dynamic Company and consulting engineer for several automobile companies.

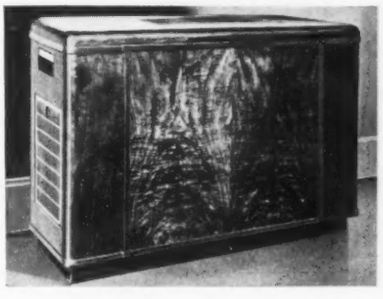
William F. Sauter, industrialist and chairman of the board of the American Engineering Company, Philadelphia, died in that city April 6 in his seventy-fourth year. Mr. Sauter was also a director in several companies affiliated with the American Engineering Company.

Harry P. Chandler, an executive assistant of the Public Service Corporation of New Jersey, died April 3, at his home in Asbury Park, as the result of a stroke. He was 60 years of age. A native of Newark, Mr. Chandler started with the old Newark Electric & Power Company 43 years ago as a collector, rising to general bookkeeper and cashier. He became identified with the United Electric Company in 1900 as Newark agent. Mr. Chandler spent seventeen years as division agent of the central division for Public Service and was made executive assistant in 1926.

NEW EQUIPMENT

Portable Room Coolers

Self-contained portable summer air-conditioning units requiring only electrical cord and hose connections have been announced by the Westinghouse Electric & Manufacturing Company.



"Mobilaire" coolers circulate, dehumidify and cool the air and require no major alterations for installation. Steel cabinets in three finishes are offered for these ½-ton units, which measure 38 x 25 x 13½ in. The height is 29 in. with casters and the weight of the units is 350 lb. Mobilaire units are suitable for homes, offices, hotel rooms, small stores or other rooms of about 150 to 300 sq.ft. floor area.

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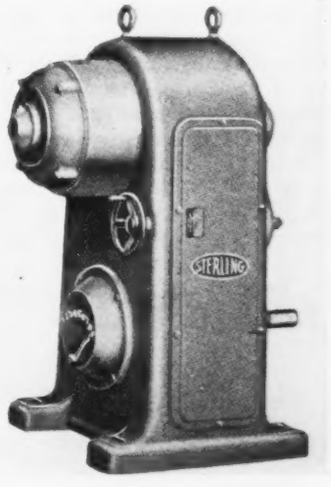
Non-inflammable, totally inclosed capacitors for use in dusty atmospheres of grain mills, textile mills, etc., have been introduced by the General Electric Company, Schenectady. Use of non-inflammable "Pyranol" of high dielectric and insulating strength permits smaller and lighter over-all units. The capacitor dielectric itself is hermetically sealed and connections are brought out through bushings into a dust-proof box surmounting the capacitor unit. This box is provided with conduit holes, each provided with dust cap and containing standard N.E.C. indicating fuses, which can be easily inspected by removing the gasketed cover, held by two winged nuts on hinged studs attached to the tank.

Upright Design Added

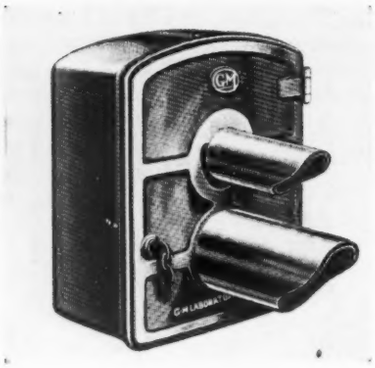
Similar in mechanism to its horizontal design, upright design "Vari-Speed" inclosed motors have been introduced by Sterling Electric Motors, Inc., Los Angeles. They are available in ratings up to 15 hp. with infinite speed variation and standard variations are 2:1, 3:1, 4:1. Standard remote-control acces-



sories can be used. "Slo or Hi-speed gears" on the output shaft can be furnished as in the horizontal types. Ball bearings are used throughout, speed is

constant at any setting of the pulleys and motors can be mounted in any position. Described in Bulletin No. 133.

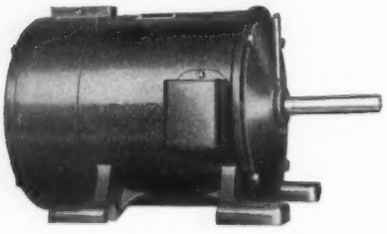
Outdoor Photo Relays



Completely inclosed weatherproof photoelectric relays for outdoor use have been announced by the G-M Laboratories, Inc., Chicago. A variety of photoelectric circuits can be furnished for best results in a given installation. Relays are completely inclosed in cast aluminum case with hinged gasketed covers that can be fitted with tubular visors to protect the lenses in front of either the cell, lamp or both from rain, snow, sleet or extraneous light effects. The unit illustrated operates on standard 110-volt circuits and is designed to signal watchmen if beams are interrupted. Light from the lamp behind the upper visor is focused from a mirror 20 ft. away back to the photocell behind the lower visor.

Air-Conditioning Motors for Railway Service

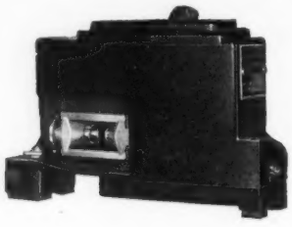
Direct-current motors to meet the special requirements of air-conditioning equipment on railway cars have been developed by the Century Electric Company of St. Louis, Mo. The electrical characteristics are designed to meet the requirements of varying voltage due to the change in speed of the generating unit driven from the trucks of the railway car and also for storage battery operation when the car is not in motion.



The frame used is cast or rolled steel with welded steel feet. End brackets are cast steel; bearings are grease lubricated ball bearings. Brushes and commutator are easily accessible, the openings used being closed with a sheet metal ring similar to the construction of an axle generator. Frame and end brackets are solid except for these brush and commutator holes.

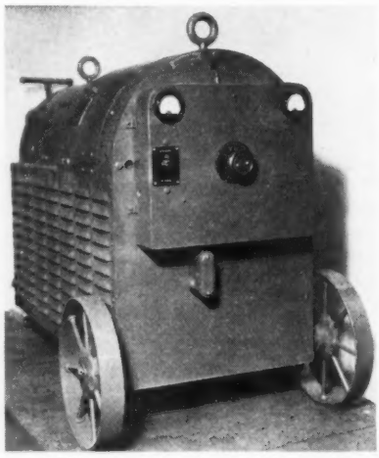
Compression Breakers

Compression type industrial circuit breakers, type AF-1, in which arcs are confined to a closed metal cylinder have been announced by the Trumbull Electric Manufacturing Company, Plainville, Conn. An exclusive feature is an entirely different method of arc interruption. When the breaker trips an overload the contacts part and the arc



generates gases that set up a pressure within the cylinder, which increases the resistance of the arc so rapidly that interruption is said to occur in 0.008 second. Operation is speedy and quiet with no external arc.

Heavy Service Welders



Designed for the heavy service required in steel mills and shipyards, a 400-amp. direct-current welder for either bare or coated electrode service has been introduced by the Westinghouse Electric & Manufacturing Company. The welder is driven by a 25-hp., 230-volt d.c. motor. Unit frame construction is used which incorporates many of the latest features. The polarity is easily reversed by turning a simple thumb switch.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

IMPROVING POWER FACTOR FOR PROFIT, G.E. capacitors pyranol-treated, Bulletin GEA-77F of the General Electric Company, Schenectady, N. Y., 27 pages, January, 1934. Applications, illustrations, circuit diagrams and prices of "Pyranol" treated capacitors together with a typical power-factor survey.

EXPLOSION-PROOF CONDULETS for Hazardous Locations, Bulletin 2282 of the Crouse-Hinds Company, Syracuse, N. Y., 64 pages, March 11, 1934. Installations and lists of prices and sizes of explosion- and vapor-proof equipment.

BROWN RESISTANCE THERMOMETERS for measuring temperatures from —300 deg. to +1,000 deg. F., Catalog No. 9001, the Brown Instrument Company, Philadelphia, Pa., 32 pages. Description with illustrations of Brown indicating, recording and controlling types of resistance thermometers with new and improved features.

BAKELITE MOLDED materials and their uses, sixth edition of the Bakelite Corporation, New York, N. Y., 48 pages, March, 1934. Indicates the different materials and their uses together with a description of the molding process and needed equipment.

FREYN DESIGN publication No. 11 for March, 1934, of the Freyn Engineering Company, Chicago, Ill., 24 pages. Articles on blast furnaces and their equipment and illustrated descriptions of Freyn design steel mill equipment.

GRAPHICAL SYMBOLS USED FOR ELECTRIC POWER AND WIRING, approved as tentative standard by the American Standards Association; A.I.E.E. No. 17g2, five pages, January, 1934. Price 20 cents.

ELECTRIC ARC-WELDING APPARATUS approved as tentative standard by the American Standards Association; A.I.E.E. No. 38, eleven pages, January, 1934. Price 40 cents.

GRAPHICAL SYMBOLS USED FOR ELECTRIC TRACTION, including railway signaling, approved as tentative standard by American Standards Association; A.I.E.E. No. 17g5, 20 pages, January, 1934. Price 40 cents.

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